DOCUMENT RESUME

ED 407 077 PS 025 154

AUTHOR	Lee, Valerie E.; And Others
TITLE	The Influence of School Climate on Gender Differences in the Achievement and Engagement of Young Adolescents.
INSTITUTION	American Association of Univ. Women Educational Foundation, Washington, D.C.
PUB DATE	96
NOTE	55p.
AVAILABLE FROM	American Association of University Educational Foundation/AAUW, AAUW Sales Office, Department 403, P.O. Box 251, Annapolis Junction, MD 20701-0251; 800-225-9998, ext. 403 (Members, $10.95; non-members, $12.95).
PUB TYPE	Reports - Research (143)
EDRS PRICE	EDRS Price MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Academic Achievement; Catholic Schools; Discipline; *Educational Environment; *Equal Education; Grade 8; *Junior High School Students; Junior High Schools; Mathematics Achievement; *Middle Schools; Public Schools; Reading Achievement; *School Effectiveness; School Size; Sex Differences; Social Studies; Socioeconomic Influences
IDENTIFIERS	Middle School Students; National Education Longitudinal Study 1988

ABSTRACT

This study examined elements of the climate of middle-grades schools that are associated with schools' effectiveness in terms of the engagement and achievement of their students, with special emphasis on gender equity. Drawn from the National Educational Longitudinal Study of 1988, data on 9,020 eighth graders from 377 middle-grades schools were used to examine student-level variables, such as achievement, engagement, socioeconomic status (SES), and academic background; and school-level variables, such as school composition and structure, teaching and learning climate, and normative climate. Observed gender differences in outcomes were small to moderate, favoring girls as well as boys. Climate effects are stronger for effectiveness than for equity. Teaching and learning climate effects, although modest, favor a flexible curriculum organization and authentic instruction. More substantial effects accrue from elements of normative climate, particularly academic orientation, safety, and order. Composition and structure effects are strong, particularly on reading achievement. Not all climate elements that positively influence effectiveness also induce gender equity. Implications for policy and school reform are discussed. (A description of the variables used in the study is appended. Contains 67 references.) (Author/MDM)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
X This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

ED 407 077

The Influence of School Climate on Gender Differences in the Achievement and Engagement of Young Adolescents

Valerie E. Lee, Xianglei Chen, and Becky A. Smerdon

University of Michigan

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN OTHER THAN PAPER COPY HAS BEEN GRANTED BY
Susan Rubin
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

Commissioned by the American Association of University Women Educational Foundation

PS 025154

BEST COPY AVAILABLE

Published by the

American Association of University Women
Educational Foundation
1111 Sixteenth St. N.W.
Washington, DC 20036-4873
202/728-7602

© 1996 by the University of Michigan. Printed by permission.
First printing: January 1996
Printed in the United States

The AAUW Educational Foundation provides funds to advance education, research, and self-development for women and to foster equity and positive societal change.

In principle and practice, the AAUW Educational Foundation values and supports diversity. There shall be no barriers to full participation in this organization on the basis of gender, race, creed, age, sexual orientation, national origin, or disability.

AAUW
EDUCATIONAL
FOUNDATION

The Influence of School Climate on Gender Differences in the Achievement and Engagement of Young Adolescents

Abstract

This study identifies elements of the climate of middle-grade schools that are associated with schools' *effectiveness* in terms of the engagement and achievement of their students. Of special interest is how school climate influences gender *equity* , defined as systematic differences in achievement and engagement between eighth-grade boys and girls. Using data on more than 9,000 students in almost 400 schools drawn from the base year of the National Educational Longitudinal Study of 1988 (NELS:88), school climate is defined on several dimensions: teaching and learning climate, normative climate, and composition/structure climate. The nested research questions and data are addressed with hierarchical linear modeling (HLM) methods. Observed gender differences in outcomes are small to moderate, favoring girls as well as boys. Climate effects are stronger for effectiveness than for equity. Teaching and learning climate effects, although modest, favor a flexible curriculum organization and authentic instruction. More substantial effects accrue from elements of normative climate, particularly academic orientation, safety, and order. Composition and structure effects are strong, particularly on reading achievement. Not all climate elements that positively influence effectiveness also induce gender equity. Implications for policy and school reform are discussed.

We are grateful to the American Association of University Women Educational Foundation for its support of this research. The design and conclusions drawn from the research, and any opinions or errors therein, however, are entirely our own—*Valerie E. Lee, Xianglei Chen, and Becky A. Smerdon.*

THE INFLUENCE OF SCHOOL CLIMATE ON GENDER DIFFERENCES IN THE ACHIEVEMENT AND ENGAGEMENT OF YOUNG ADOLESCENTS

There is an abundance of research on gender differences in educational performance. Recently the "gender gap" itself has become a hot political issue (Schmidt, 1994), as parties interested in the debate argue about the magnitude, causes, and importance of the gap.[1] In this study, we draw on a large and nationally representative study of middle-grade students' school progress to investigate gender differences in achievement and engagement. After reporting the location, magnitude, and direction of "gender gaps," we focus on the climate of middle-grade schools as an explanatory factor for gender-based performance and engagement differences in young adolescents.

Although gender differences in mathematics and science are either nonexistent or very small throughout elementary school, they emerge in the middle grades and expand as students progress through high school (Linn & Hyde, 1989). In these subjects, boys typically outperform girls. In reading and writing achievement, where gender differences are reported as early as fourth grade, girls usually outperform boys (Jones, Mullis, Raizen, Weiss, & Weston, 1992). Curiously, writers and researchers have devoted much more attention, both substantive and empirical, to educational outcomes in which girls are at a disadvantage. Studies have identified numerous factors to account for gender differences in academic achievement and engagement, the majority of which have focused on characteristics of children and their families. These factors include differential parental expectations and encouragement of girls and boys (Astin, 1974; Oakes, 1990) and girls' and boys' different attitudes, motivation, and interests (AAUW, 1991; Cannon & Simpson, 1985; Jones & Wheatley, 1990; Simpson & Oliver, 1985, 1990).

Another research strand, less common but as important, has identified classroom factors (especially teachers and instruction) associated with gender differences in academic attitudes, expectations, and/or performance. Classroom factors include differential teacher expectations (Crossman, 1987; Good, Sikes, & Brophy, 1973; Jones & Kirk, 1990; Parsons, Kaczala, & Meece, 1982; Spear, 1987), student-teacher interactions (Parsons et al., 1982), differential teacher treatment (AAUW, 1992; Sadker & Sadker, 1994; Simpson & Erickson, 1983), and classroom influences and environment (Eccles, 1989; Jones & Wheatley, 1990; Morse & Handley, 1985).

The guiding focus for this study is more compatible with the second than the first research strand. Unfortunately, our search of the literature has yielded very few attempts to link school *organizational* factors (i.e., characteristics of schools that reach beyond the classroom) with gender differences in academic outcomes. A major reason for the paucity of studies exploring gender issues and school environment, often called climate, is an imprecise definition of this construct. Very few studies have explored the notion of school climate explicitly, either by reviewing published research on the topic (e.g., Anderson, 1982) or conducting an empirical investigation that suggests problems with the construct itself (e.g., Pallas, 1988).

A lingering question is whether (and why) the climate or environment of the typical U.S. school seems to foster gender differences. We adopt a novel approach, substantively and methodologically, to identify institutional and organizational conditions associated with gender differences in academic achievement and engagement. Our aim is to provide a substantive theoretical and empirical base that enriches the dialogue around school reform. We believe that *gender* should be systematically included in discussions of educational equity, which have heretofore mainly targeted race, ethnicity, or economic disadvantage.

This study rejects research designs that focus solely on the characteristics of individual students and explanations that locate responsibility and solutions with individuals and families. We aim to identify school conditions that improve the educational development of *all* students, male and female. Our developmental focus is on young adolescents in middle schools, rather than elementary schools (Gaddy, 1988) or secondary schools (Pallas, 1988). Findings from studies of elementary school environments typically are not applicable to the middle grades. Middle schools differ from elementary schools in size, organizational complexity, diversity of goals, variability of student background, course offerings, students' developmental levels (Gaddy, 1988) and differentiation of student experiences by ability level (Carnegie Council on Adolescent Development 1989).

Because of weaknesses in the research base on school climate, we develop our own theory. We define the construct along three dimensions. One dimension considers school environment based on *teaching and learning*. This dimension includes the degree to which school curriculum is flexible (marked by a minimum of departmentalization and grouping by ability, and an emphasis on team teaching), instruction is authentic (student-centered and focused on problem-solving), and social relations are positive. Another dimension of school climate is the *normative environment*, which includes measures of order, discipline, and safety (e.g., rules and discipline, and levels of crime, abuse, and fear), students' orientation toward academic learning (e.g., tardiness, absenteeism, and student attitudes toward their class), and parents' involvement (e.g., contact with school, teachers, and counselors; monitoring of their children's homework). Another dimension of school climate is related to the school's *structure and composition*. Factors include racial concentration, degree of urbanization, size, and average socioeconomic status of the schools.

Our focus on the middle grades derives from research identifying early adolescence as the developmental stage when a gender gap favoring boys often emerges in self-perception and school performance (AAUW, 1992). Early adolescence is also a critical time for girls' development of academic interests and attitudes. During this period, girls are sensitive to others' perceptions, and rate popularity and being liked as more desirable personal attributes than independence and competence (Orenstein, 1994). Gender-role-appropriate activities become important as students move from elementary to junior high school. Students of both genders increasingly conform to stereotypes for behavior (AAUW, 1992; Wigfield, Eccles, MacIver, Reuman, & Midgley, 1991). Girls' attitudes about mathematics become more negative at this point, while their attitudes about English

become more positive. Girls experience some decline in self-confidence as young adolescents, and their interest in science and mathematics begins to decline (Jones & Wheatley, 1992; Simpson & Erickson, 1990). Changing attitudes affect choices in high school—i.e., some girls choose to take fewer mathematics and science courses (Wigfield et al., 1991).

Background

School Climate: What is It? How Should We Study It?

A problematic construct. Research on school climate (particularly the climate of elementary schools) is plentiful. Much of this research, with a strongly empirical flavor, was conducted in the early 1980s to identify characteristics of effective schools. However, "its theoretical base is weak," according to Lee, Bryk, and Smith (1993, p. 209). A typical study would identify several measures of a school's culture or ecology[2] and then relate them statistically to an important outcome, e.g., academic achievement. Anderson's (1982) thorough review of the school climate literature is also quite critical. She contends that such research has used a variety of causal models (often inconsistent with one another or even internally inconsistent), inadequate research designs, and improper statistical analyses. Quite often, statistical results are misinterpreted.

With data from more than 10,000 teachers in a nationally representative sample of about 400 U.S. high schools, Pallas (1988) used teachers' responses to construct several measures of school climate identified as important in other studies: principal leadership, teacher control, staff cooperation, student behavior, and goal consensus. Although the measures had strong psychometric properties, Pallas was surprised to find that the lion's share of variance in these measures (more than 80%) was between teachers within schools, and not between schools. Pallas concedes that high schools are more heterogeneous than elementary schools in terms of the diversity of students and school goals, and thus, the within-school variability in high schools may be larger. He concludes that "the results here sound a cautionary note on the potential for school climate to foster school improvement" (p. 553).

In a theoretical and empirical examination of school organizational properties (communal organization, in particular), Bryk and Driscoll (1988) distinguish between the school constructs of organization and climate. The notion of school organization (with its structural, normative, and functional elements) has strong foundational roots in sociology, especially in the idea of the school as a "small society" laid out by Waller (1932) and Bidwell (1965). This construct stands in sharp contrast to school climate research, most of which is psychologically based (Anderson, 1982).

Because we take seriously the critical stance of respected researchers on the empirical study of school climate and its effects, we faced a dilemma. Much of the research that relates classroom and school conditions to gender issues in schools is framed within the school climate domain. As we relied on this body of research to guide our study, we found it difficult to back away completely

from the school climate construct. On the other hand, we framed our research in a sociological tradition that has typically focused on school organization rather than climate.

Our approach to using this construct. To frame the study, we decided on a compromise. Because of its familiarity in the lexicon of educational research, we retained the phrase "*school climate*" to define the features of schools that we investigated. We based our measures of this construct, however, on the theoretical literature defining school organization rather than on the climate literature. Equally important, we selected a particular statistical methodology, hierarchical linear modeling, or HLM, to study these effects. We argue that this method, which is almost totally absent from the school climate studies we reviewed, is the appropriate way to study how school climate affects student outcomes and how the effects of climate vary by gender.

We used the elements of climate we defined as the framework for our study of the classroom or school contexts in which gender differences in academic outcomes occur. Our review of the relevant empirical research is organized around three elements of school climate: (1) school composition and structure climate, (2) teaching and learning climate, and (3) normative climate. Besides summarizing relevant studies, we highlight issues that have been overlooked in research on this topic. We end the section by laying out the research questions explored in this study.

Composition and Structure Climate

School SES, school size, and racial composition. Few studies define school demographic factors (e.g., socioeconomic status [SES], degree of urbanization, or racial composition) as characteristics of climate. Fewer yet link these issues with gender differences in academic outcomes. However, many studies examine academic outcomes for all students in urban, low-SES schools; this approach suggests obstacles both girls and boys face that may be related to compositional characteristics of schools.

A welcome exception is a recent study by Entwisle, Alexander, and Olson (1994) that assessed the effects of aggregate demographic factors on gender differences in mathematics learning over the first two years of elementary school. Centered in a single city (Baltimore), the study employed the same methodology we use in this paper (HLM). Entwisle et al. found a gender gap in math learning favoring boys, even among young children. The gap, however, was significantly smaller for children attending schools in higher-income Baltimore neighborhoods and in schools with more educated parents. The study's strength lies in its focus on mathematics gains, its interest in how demographic climate factors affect gender differences in gains, and its use of appropriate methods for this type
of study.

Urban schools are typically large, and school size is negatively related to average levels of academic engagement and achievement (Lee & Smith, 1995). Likewise, schools with larger eighth

grades evidence increased social stratification in achievement (Lee & Smith, 1993). Educational equity is greatly affected by school size, with larger schools characterized by social stratification in learning opportunities and academic outcomes (Garbarino, 1980; Lee & Bryk, 1989) and by heightened alienation (Newmann, 1981). However, school size alone shares a weak relationship with academic achievement. In large, high-SES schools, students may have opportunities with few constraints on the allocation of resources, whereas in large, low-SES schools, students typically have fewer opportunities and fewer resources (Friedkin & Necochea, 1988). This suggests an interaction between school size and social composition.

Poor students frequently attend school with other poor students (Orland, 1990). Typically these schools also have high minority enrollments, especially in urban areas (Comer, 1988; Wilson, 1987). Yale psychiatrist James Comer (1985) suggests that the psychological and social distance between schooling and poor minority children's larger environments is unique to recent generations. Poor children's families in earlier generations worked and sometimes lived among the middle class, who provided evidence of a better way of life. However, today's inner-city children are isolated in their poverty. Faced with meager employment prospects, few supportive community institutions, and isolation from children and adults who have anything better, many poor and minority children and parents respond to school opportunities differently from those in more privileged communities.

Students attending low-SES schools also encounter different educational opportunities and experiences than students in schools with more advantaged students. Low-SES schools typically exercise fewer reform practices identified as beneficial to student achievement (Lee & Smith, 1995). For example, low-SES middle schools have fewer regular laboratory components in their science classes (Lee & Burkham, 1996), low-SES schools seldom use team teaching (Lee & Smith, 1993), and students attending low-SES schools, including those in college preparatory programs, typically take fewer academic classes (Oakes, 1990). It is not surprising that engagement is somewhat higher for early adolescents in higher-SES schools (Lee & Smith, 1993).

Research suggests that gender differences within schools exist in both urban schools and schools of different SES composition. In general, eighth-grade boys from advantaged and disadvantaged urban, rural, and suburban schools outperform their female peers on standardized science tests (Jones et al., 1992). Moreover, gender differences in career interest in science are equivalent across high- and low-SES schools: Boys are more interested than girls. Empirical studies suggest that gender differences in interest in science careers are also constant across predominantly African American or white schools. Additionally, boys in both suburban and urban schools report significantly more science experiences and extracurricular activities than their female peers (Kahle, Matyas, & Cho, 1985).

BEST COPY AVAILABLE

Teaching and Learning Environment

Authentic instruction. Numerous studies link instruction to academic achievement, and many seek to associate differences in instruction with gender differences in achievement. For example, authentic instruction, which we define as teachers' efforts to encourage students to construct (rather than reproduce) knowledge, may positively affect girls' achievement. Girls typically perform better in science if their classes have a laboratory component. Hands-on science activities have been introduced, in part, to boost girls' interest in science, to encourage them to take more science courses, and to raise their confidence in this subject (AAUW, 1992; Eccles, 1989; Lee & Burkam, 1996). "Real world" applications of math and science help girls see the relevance of these subjects in their lives (AAUW, 1992).

An important component of laboratory classes is the stress placed on student-centered learning (Eccles, 1989). One study suggests that girls show fewer gains in understanding and applying math concepts in classes where they are more often engaged in one-to-one interaction with the teacher than in classes where they receive less help (Peterson & Fennema, 1985). This finding may reflect a kind of dependency by girls that is counter-productive to their learning. Classes focusing on activities rather than teacher talk or interactions with teachers seem to be more equalizing in the experiences provided to students (AAUW, 1992). In studies of exemplary science programs in middle/junior high schools that include activity-oriented classrooms (e.g., daily hands-on activities, regular student reports and projects, and library use), students develop strong positive attitudes toward science while demonstrating high levels of scientific knowledge (Brunkhorst, 1992).

Student-teacher interactions. Many studies of gender differences in teacher expectations and interactions link these differences to gender gaps in achievement and engagement. These studies provide important insight into one aspect of the hidden curriculum: formal and informal exchanges between teachers and students. Although some student-teacher interactions positively impact girls' achievement and self-esteem, other studies of student-teacher interactions (especially in science classrooms) identify patterns of interaction that impede girls' learning.

Many teachers treat male and female students differently. They often have higher educational expectations for boys (Good et al., 1973) and believe that science is more important for boys than for girls (Spear, 1987). These teachers invest more energy in boys, in terms of disciplining and teaching them. Attention to boys typically consists of precise and penetrating feedback, whereas comments to girls are often vague and superficial (AAUW, 1992, Sadker & Sadker, 1994). Though boys generally receive more attention (positive as well as negative) from teachers (Sadker & Sadker, 1994; Simpson & Erickson, 1983), in the middle grades, girls for whom teachers have high expectations are often subject to more public criticism. Girls develop lower expectations in classes where they are treated differentially, which may affect their ability to perform (Parsons et al., 1982).

As a result, girls sometimes feel powerless in academic situations and abandon academic tasks more easily (AAUW, 1992).

Grouping practices. Instruction often differentiates what is taught and to whom—generally called either *ability grouping* (in elementary schools) or *tracking* (in high schools). Students in upper tracks share high academic status, self-esteem, and increased motivation to learn besides an increase in quality and quantity of instruction. Low-track students are often subjected to "dull, repetitive instructional programs leading at best to minimum competencies" (Carnegie Report, 1989). According to the Carnegie Council of Adolescent Development (1989), "tracking has proven to be one of the most divisive and damaging school practices in existence" (p. 49), for early adolescents especially. Given fundamental differences in high- and low-track classes, tracking as an instructional and organizational practice is an element of school climate that offers differential learning opportunities to students.

Few researchers define tracking as a characteristic of school climate; instead, they accept it as an essential fact of school life. A potential link between grouping or tracking practices has been overlooked in studies on gender differences in achievement and engagement. Studies of tracking typically focus on achievement differences associated with race, ethnicity, and SES, probably because girls are often underrepresented in low-ability groups (Hallinan & Sorensen, 1987). Studies of curriculum differentiation typically examine stratification in achievement within schools, ignoring between-school differences in these effects. Demographic characteristics of the school and its students may determine the size, ability level, and composition of tracks. Racial, ethnic, and SES composition of schools may affect tracking assignments (Hallinan, 1994). High-achieving boys are more often assigned to high-ability groups and experience high-quality instruction than their female peers. Nevertheless, Hallinan & Sorensen (1987) report that girls experience no differential effects of membership in the high (or low) group.

Grouping practices may, however, generate social-psychological processes that affect the genders differently. The more teachers stress the importance of good grades and scores on standardized tests, the more homogeneous classroom cliques (formal and informal) become in terms of ability. Friendship cliques in these classes form a hierarchy based on achievement, and high-ability students make fewer friends (Hallinan & Smith, 1989). For girls, peer interest and social belonging are especially strongly linked to interest in school; interest in school, in turn, is strongly associated with grades. Interest in school, peer influence, a sense of belonging, and the other factors of the general social climate are also more important in the dropout decision for girls than for boys (Pittman, 1991). Therefore, the constrained friendships in high-ability classes may affect girls' grades and possibly their decision to remain in those classes.

Normative Climate

Orderly and safe environment. A few studies identify safety and order as important characteristics of school climate. Some studies identify such classroom and school characteristics as competition, supervision, and disciplinary measures that are associated with delinquency for boys and girls (Figueira-McDonough, 1986; Whitney & Smith, 1993). Safety and order are essential elements of an effective learning environment (AAUW, 1992). However, these studies fail to frame either a convincing theoretical structure or an empirical connection among the elements of safety and order, academic achievement, engagement, and gender. Rather, such studies typically examine gender differences in victims and victimizers and then conclude that victimization limits learning and affects course selection.

An element of safety and order related to gender is sexual harassment. Elements of sexual harassment in school include name calling (including racist and sexist remarks), threats of physical violence, rumor mongering, isolation and alienation, theft of personal belongings, and physical abuse (AAUW, 1993; Whitney & Smith, 1993). A recent British study indicates that girls are victimized as often as boys, but boys (generally older boys) victimize others more often. Moreover, boys and girls typically harass others in different forms: Boys generally practice physical forms of harassment and girls practice indirect and verbal harassment (Whitney & Smith, 1993).

A recent study focuses on a "culture of sexual harassment" in schools, where harassed students (males and females) frequently are also harassers themselves and associate with friends who engage in harassment (Lee, Croninger, Linn, & Chen, in press). This finding alters the traditional view of girls as "victims" and boys as "perpetrators." A 1993 AAUW report describes an increase over time in sexual harassment among middle-grade students, suggesting that peer interaction is an aspect of informal education that often has negative implications for girls.

Harassment, for example, often leads to academic or psychological problems, especially for girls (Lee et al., in press). Harassment also inhibits girls' participation in activities or courses viewed as stereotypically male (e.g., science). When it takes place in classrooms, harassment makes students feel unaccepted and limits their opportunity to learn in unknown ways (AAUW, 1993). Whitney and Smith (1993) found that harassment typically occurs in undersupervised locations, especially in schools without clear policies or supportive climates for victims. When school officials fail to deal swiftly with harassment, they grant tacit consent to this behavior (AAUW, 1993; Lee et al., in press).

Academic-oriented learning environment. Prior research indicates that instructional practices contribute to gender differences in achievement and engagement. The evidence indicates that competitive learning environments negatively affect girls' achievement, while enhancing that of boys. Competitive classrooms that foster social comparisons, stress public drills, and have interactions with teachers that are dominated by a few students typically disadvantage girls (Peterson &

Fennema, 1985). A very competitive environment may in fact limit all students' academic development. Highly competitive, teacher-centered classes offering little teacher support and stringent grading criteria have higher student absenteeism and delinquency (Moos & Moos, 1978). For girls experiencing less academic success, a competitive classroom climate increases the frequency of their delinquency compared to their academically successful counterparts (Figueira-McDonough, 1986). Although this body of research is seen as quite separate from that on tracking and ability grouping, the topics are conceptually similar.

Classrooms promoting gender equity (sometimes termed "girl friendly") share some characteristics: a de-emphasis on social comparisons and competition; an emphasis on collaboration; space and time for exploring diversity of opinion; and a focus on cooperative learning (AAUW, 1992; Eccles, 1989). Some researchers find that the characteristics of "girl friendly" classrooms also enhance boys' learning. For example, Petersen, Johnson, and Johnson (1991) suggest that cooperative learning has an equalizing effect on gender differences in achievement, oral participation, perceived leadership, and status. However, a study in exemplary middle schools suggests that social stratification (including ranking by gender) is possible, if teachers allow cooperative learning groups to be led by the same students who dominate typical classrooms (Cohen & Lotan, 1995).

Parental involvement. There is considerable empirical evidence that parental involvement in school-related activities is related to academic achievement for both white boys and girls (Epstein, 1991; Ginsburg & Bronstein, 1993; Steinberg, Lanborn, Dornbusch, & Darling, 1992; Stevenson & Baker, 1987), though it may not be related to school engagement (Steinberg et al., 1992). Among African American students, however, parental involvement is not significantly related to academic achievement. Though parents are involved in both boys' and girls' education equally (Grolnick & Slowiaczek, 1994; Steinberg et al., 1992), parents of boys are more involved in school activities when their sons are young; parental involvement does not vary for girls of different ages (Stevenson & Baker, 1987).

There is some evidence that parental involvement in school does not necessarily enhance girls' achievement, as parents themselves may be the source of differential expectations for their male and female children. One study suggests that parental involvement has more impact on the school performance of girls than boys (Stevenson & Baker, 1987) and that this impact may not always be positive. Many parents have expectations for and perceptions of their children that vary by the child's gender. Parents often believe that girls find mathematics more difficult and think that math courses are more important for boys, even when girls' performance equals or exceeds boys'. Parental expectations are related to students' perceptions of their math ability (Oakes, 1990). Parental involvement is thus not synonymous with parental encouragement, and parental involvement in school may reinforce traditional beliefs about gender-related differences in academic ability.

Research Questions

Our focus is on gender differences in academic achievement and school engagement among early adolescents. After identifying the magnitude and direction of gender differences in these outcomes, we examine how the climates of the middle-grade schools these students attend affect achievement and engagement, and whether (and how) elements of climate are associated with gender differences in these outcomes. We delimit school climate (as an organizational feature of schools) on three dimensions: composition and structure, teaching and learning, and normative environment. We organize our analyses around three interdependent research questions:

Research question 1. Does the academic achievement and school engagement of eighth-grade students vary by gender? If there are gender differences, which gender is favored on these outcomes? Do these gender gaps persist once other demographic characteristics of students (race, ethnicity, and social class) are taken into account?

Research question 2. Do the gender gaps in achievement and engagement vary systematically between schools? That is, would these gender gaps be even possibly amenable to the influence of school climate?

Research question 3. Are the gender differences in eighth graders' achievement and engagement influenced by elements of the schools' climates? Which of the climate elements considered—composition and structure, teaching and learning, or normative environment—is most strongly associated with students' achievement and engagement, and with gender differences in these outcomes? Within each climate construct, are there particular features of that type of climate that are more important than others in influencing girls' and boys' academic achievement and engagement?

Method

Sample and Data

We drew our sample from the base year of the National Educational Longitudinal Study of 1988 (NELS:88), a general-purpose study of the educational status and progress of eighth-grade students in U.S. middle-grade schools (Ingels, Abraham, Spence, & Frankel, 1989). The study employs a subsample of NELS students who fit the following data filters: (a) students with data from all NELS data sources (students, parents, schools, and teachers); (b) students who were enrolled in coeducational public, Catholic, and independent schools, each of which contains at least 10 NELS-sampled students;[3] and (c) a random sampling down of public schools.[4]

Application of these filters resulted in a sample of 9,020 eighth graders, averaging 29 students in each of 377 middle-grade schools: 258 public, 80 Catholic, and 39 independent schools.[5] Since the original NELS design oversampled certain types of schools (private schools and schools with high concentrations of Hispanics and Asians), we used the appropriate NELS design weights for all analyses, adjusting for our further sampling down of public schools.[6] A series of analyses of schools and students verified that our sample is statistically equivalent to the full NELS sample from the first and second data filters. Results may thus be generalized to 1988 U.S. eighth-grade students attending public, Catholic, and independent schools.

Measures

Dependent variables. As the literature suggests, gender differences exist not only in academic performance, but also in attitudes, learning behaviors, motivation, and participation. Looking beyond achievement, we included engagement with learning as an outcome. We explored students' achievement in four curriculum areas: reading, mathematics, science, and social studies. Engagement with academics is a composite of three subfactors: positive academic behaviors; student preparation for classroom instruction; and school attendance. Details of the construction of all measures used in this study, along with the NELS variables from which they were drawn and the psychometric properties of all composites, are presented in Appendix A. All composites were constructed with factor analysis methods, using the principal components and varimax options.

Independent variables: school climate measures. Each of the broad constructs measuring the climate of American middle-grade schools describes a different organizational or structural aspect of schools: composition (i.e., who goes there?), instruction (i.e., what is taught there, to whom and how is it taught?), and elements of the school environment that are not directly tied to instruction (i.e., how do people behave there?). Each construct is tapped by a set of measures, most often drawn from reports of individual students or teachers and aggregated to the school level.

School composition and structure climate taps the school's demographic composition, governance, and size. Two variables measure demographic composition: average school SES and minority concentration. Governance is tapped by dummy variables representing two types of private schools (Catholic and independent), with public schools serving as the comparison for each group. School size is the number of eighth graders in the school.[7]

The *teaching and learning climate* construct includes three factors: (a) flexible curriculum organization (a composite of reduced departmental structure, heterogeneously grouped instruction, and team teaching); (b) authentic instruction (in English, mathematics, science, and social studies); and (c) positive relations among students and teachers. *Normative climate* includes measures of (a) safe and orderly school environment (including students' and teachers' perceptions about school safety and the orderliness of classrooms and schools); (b) academic orientation or press of the

school (gathered from parents' reports of school academic focus and student reports of time spent on homework); and (c) voluntary parental involvement in school affairs (derived from parents' reports of membership in and attendance of PTO or PTA, participation in PTO activities, and volunteer work at the school).

Independent variables. Students' gender is the focus of the study. We also include other student characteristics as statistical controls: (a) SES (family income, parental education, parents' occupational status, and educationally related possessions in the home); (b) minority status;[8] and (c) academic background (a proxy for student ability, including a measure of prior grades and whether the student ever skipped or repeated a grade). Although there is little evidence that girls and boys vary systematically by these characteristics, it is standard practice to include such controls to eliminate possible alternative explanations for our findings. It is well known that demographic characteristics are associated with the outcomes used in this study.

Analytic Approach

Descriptive analyses. We begin by documenting observed group means by gender in the measures under study here (Question 1). Do eighth-grade boys and girls differ in their levels of academic achievement and engagement? Any gender gaps in these outcomes become the center of attention. We also present group means by gender for the demographic characteristics considered here. We consider the climates of schools that girls and boys attend. The statistical significance of observed gender differences on all variables was tested with *t* tests. Because the characteristics of students and schools may be associated, we examine bivariate relationships (as correlations) among test scores, engagement, and demographic characteristics. We also consider associations among school-climate measure, by computing zero-order correlations between characteristics of schools rather than students.

Multilevel analyses. Our major analytical tasks are to investigate (a) whether the gender gaps in each outcome vary systematically between schools (Question 2), and (b) how elements of climate influence school-by-school differences in our outcomes, as well as gender gaps in the outcomes (Question 3). The type of study generated by the latter is often labeled "school-effects research." Such research questions are multilevel (i.e., they estimate the effects of school characteristics on student outcomes); thus, statistical techniques must take into account the nested nature of data and questions. We use a well-known multilevel statistical method, HLM. For readers unfamiliar with this technique, we include a brief description of a typical HLM statistical model for the study in Appendix B. Details of the HLM technique and its statistical theory are explained elsewhere (Bryk & Raudenbush, 1992; Lee & Bryk, 1989); we refer readers interested in more detail to these sources.

Results

Descriptive Differences Between Male and Female Students

Table 1 displays group means for male and female eighth graders on all variables. The pattern of gender differences is inconsistent. In some cases, females are favored; in others males are favored. Statistical significance, probabilities, and *t* statistics associated with group means differences on each variable are indicated in the right-hand column of Table 1. Variables are organized into those describing students (Part I, N = 9,020) and schools (Part II, N = 377). Student sample sizes are almost equivalent by gender.

Table 1

Means of Model Variables for Eighth-Grade Male and Female Students

Variables	Male (*n* = 4,452)	Female (*n* = 4,568)*	T-Statistics for Gender Differences
I. Student-Level Variables (*N* = 9,020 Students)			
A. Dependent Variables			
Reading Achievement ♦	- 0.12	0.12	- 11.27 ***
Math Achievement ♦	0.01	- 0.01	1.05
Science Achievement ♦	0.06	- 0.06	5.66 ***
Social Studies Achievement ♦	0.04	- 0.04	3.72 ***
Engagement with Learning ♦	- 0.19	0.19	- 18.29 ***
B. Demographic Variables			
Socioeconomic Status ♦	0.02	- 0.02	2.19 *
Academic Background ♦	- 0.10	0.10	- 9.67 ***
% Minority Status	23.12	23.89	- 0.85
II. School-Level Variables (N = 377 Schools)			
A. Composition and Structure Climate			
Average School SES ♦	0.00	0.00	0.34
Eighth-Grade Enrollment	208.92	212.91	- 1.26
% High Minority Concentration	24.46	24.25	0.23
% Catholic Schools	6.90	7.39	- 0.92
% Independent Schools	0.74	0.66	0.42
B. Teaching and Learning Climate			
Flexible Curriculum Organization ♦	- 0.01	0.01	- 0.80
Authentic Instruction ♦	0.01	- 0.01	0.50
Positive Student-Teacher Relations ♦	0.00	0.00	- 0.26
C. Normative Climate			
Orderly and Safe School Climate ♦	0.02	- 0.02	1.46
Academic-Oriented Learning Climate ♦	0.01	- 0.01	1.06
Parental Involvement in School ♦	0.01	- 0.01	0.55

* $P \leq .05$
** $P \leq .01$
*** $P \leq .001$
* Sample size was unweighted. Student-level analyses were weighted by adjusted student-level weight, and school-level analyses were weighted by adjusted school-level weight.
♦ Variable were standardized with mean = 0 and standard deviation = 1 on the student sample.

BEST COPY AVAILABLE

Outcome differences. As all outcomes are in a *z* score metric, group mean differences are in effect size (standard deviation or SD) units.[9] For example, compared to their male counterparts, eighth-grade girls have a moderate advantage in reading achievement (about .24 SD) and are also more actively engaged in learning (a moderate advantage of .38 SD). Conversely, male eighth graders have small to trivial advantages over females in science (.12 SD) and social studies (.08 SD). Observed differences in the academic outcomes we consider thus show girls moderately advantaged in two (reading achievement and engagement), boys minimally advantaged in two (science and social studies achievement), and no difference in one (mathematics achievement). These gender differences, or "gaps," become outcomes in multivariate analyses.

Demographic differences. In a random sample of students, we would not expect to find gender differences in background characteristics. However, eighth-grade boys are trivially advantaged in SES (.04 SD), and girls have a small to moderate advantage in academic background (.20 SD). The proportions of male and female minority students in the sample are equivalent. Since educational research has shown that of SES, race/ethnicity, and academic background are all important influences on achievement, we include these variables in multivariate analyses as statistical controls.

Comparison of schools attended by male and female students. U.S. middle-grade schools are not homogeneous. They differ in organizational structure, resources, climates, and the characteristics of students who attend them. They also vary in their effectiveness, often measured in terms of student outcomes (usually achievement). Information in the bottom panel of Table 1 clearly shows that school climate does not vary systematically by gender.[10] As most climate measures are in the *z* score metric, these means are close to zero. The average middle-grade school's eighth-grade class has about 210 students; about a quarter of the schools have enrollments of 40% or more minority students. About 7% are Catholic schools, less than 1% are independent schools, and the overwhelming majority (over 90%) are public schools.

Correlations Between Model Variables

Measures on students. Table 1 shows that male and female students differ in engagement and achievement outcomes and that some demographic characteristics differ by gender. But are the observed gender differences in engagement and achievement simply artifacts of differing backgrounds? To begin to answer this question, we computed correlations between student outcomes and demographic characteristics, as displayed in the top panel of Table 2. Statistical tests of correlations show them all to be different from zero ($p<.001$) except between gender and math achievement. Academic achievement in all areas is strongly correlated with students' SES and academic background (*r*'s over .4) and moderately correlated with minority status and engagement (*r*'s .2-.3). As indicated by the gender differences shown in Table 1, outcome measures show modest

associations with gender (r's <.1 for achievement, <.2 for engagement). Negative correlations with gender represent a male advantage; positive correlations show a female advantage.

Table 2

Correlations Between Model Variables for Students and Schools

I. Correlations between Student Dependent and Independent Variables (n = 9,020)

	Student Independent Variables				
Student Dependent Variables	Female	Socioeconomic Status	Minority Status	Academic Background	Engagement with Learning
Engagement with Learning	0.19***	0.14***	- 0.07***	0.33***	
Reading Achievement	0.12***	0.40***	- 0.27***	0.40***	0.24***
Math Achievement	- 0.01	0.45***	- 0.31***	0.44***	0.24***
Science Achievement	- 0.06***	0.38***	- 0.30***	0.36***	0.21***
Social Studies Achievement	- 0.04***	0.40***	- 0.27***	0.38***	0.22***

II. Correlations among School Climate Variables (n = 377)

	School Climate Variables										
	School Composition and Structure Climate					Teaching and Learning Climate			Normative Climate		
	Average School SES	8th Grade Enrollment	Minority Concentration	Catholic School	Independent School	Flexible Curriculum Organization	Authentic Instruction	Student-Teacher Relations	Orderly and Safe Climate	Academic Learning Climate	Parental Involvement in School
Composition and Structure Climate											
Average School SES	1.00	- 0.13***	- 0.33***	0.36***	0.29***	- 0.11*	0.09	0.04	0.48***	0.47***	0.46***
Eighth-Grade Enrollment		1.00	0.21***	- 0.49***	- 0.05	- 0.64***	- 0.06	- 0.34***	- 0.52***	- 0.17**	- 0.50***
High Minority Concentration			1.00	- 0.02	- 0.03	- 0.08	- 0.05	0.08	- 0.34***	- 0.10*	- 0.06
Catholic School				1.00	- 0.06	0.35***	0.02	0.25***	0.55***	0.52***	0.69***
Independent School					1.00	- 0.09	0.07	0.13*	0.13*	0.28***	0.11*
Teaching and Learning Climate											
Flexible Curriculum Organization						1.00	0.05	0.20***	0.28***	0.02	0.31***
Authentic Instruction							1.00	0.07	0.13*	0.07	0.13*
Positive Student-Teacher Relations								1.00	0.45***	0.40***	0.27***
Normative Climate											
Orderly and Safety School Climate									1.00	0.57***	0.53***
Academic-Oriented Learning Climate										1.00	0.52***
Parental Involvement in School											1.00

* Ps.05
** Ps.01
*** Ps.001

BEST COPY AVAILABLE

Demographic measures other than gender show stronger associations with outcomes, consistent with the findings of other research. SES is strongly and positively associated with achievement (*r*'s about .4) and modestly associated with engagement ($r = .14$). Minority status is moderately and negatively associated with achievement and engagement. Academic background is moderately correlated with all outcomes (*r*'s about .4).

Correlations among Climate Measures

The lower panel of Table 2 shows correlations among measures of school climate. Three sets are of special interest: (1) correlations among school demographics; (2) correlations between school demographics and other measures of climate; and (3) correlations among school climate measures. Correlations between school demographics are consistent with those in the school organization literature. Catholic and independent schools have higher school SES ($r = .36$ and $r = .29$), and Catholic schools are smaller ($r = -0.49$). High-minority schools are low-SES ($r = -0.33$) and large ($r = 0.21$); larger schools also enroll lower-SES students ($r = -0.13$). Composition and structure are strongly correlated with normative climate (with many correlations in the .3-.5 range). Particularly notable are the negative associations of eighth-grade size with normative climate and the positive associations of school SES and Catholic schools. Both flexible curriculum structure and positive student-teacher relations are also higher in smaller and in Catholic schools (*r*'s between .25 and .64). Relationships of composition and structure with the teaching/learning climate measures are generally modest. Notable exceptions are the sizable negative relationships between school size and flexible curriculum organization (-.64) and student-teacher relations (-.34).

Not surprising is the considerable collinearity among measures of normative and teaching/learning climate. For example, orderly and safe schools have academic-oriented climates ($r = .57$) and have parents involved in the schools ($r = .52$). Schools with higher normative climate also have positive student-teacher relations (*r*'s between .27 and .45), flexible curriculum structures ($r = .28$ and .31), and emphasize authentic instruction ($r = .13$). A flexible curriculum structure is more common in schools with positive student-teacher relations ($r = .20$). Parental involvement in school is strongly correlated with most climate measures.

Summary. Correlations among student and school measures indicate the need for multivariate analyses to evaluate the net effect of school climate on gender gaps in outcomes. Also important are the high correlations among individual measures of school climate. This pattern of strong associations suggests that we structure our multivariate analyses to consider teaching/learning climate effects and normative climate effects individually.[11] Multilevel analyses should take into account the interrelationships shown in Tables 1 and 2.

Preliminary HLM Analysis

Unconditional HLM models. The first step in an HLM analysis is partitioning the variance in outcome measures into their within- and between-school components. In HLM parlance, such models are "fully unconditional," that is, they include no independent variables. Besides partitioning variability, unconditional HLMs estimate the reliability of each outcome. These results are displayed in Table 3.

Table 3

Fully Unconditional HLM Models for Academic Achievements and Engagement with Learning

Dependent Variables	Within-School Variability	Between-School Variability	Reliability	% of Total Variability Between Schools
Engagement with Learning	0.93	0.06***	0.59	9.77
Reading Achievement	0.78	0.21***	0.86	24.03
Math Achievement	0.69	0.30***	0.91	32.60
Science Achievement	0.76	0.23***	0.87	25.54
Social Studies Achievement	0.74	0.25***	0.88	27.36

* $P \leq .05$
** $P \leq .01$
*** $P \leq .001$

The proportion of variability between schools (or "intraclass correlation") varies by outcome, from about 10% (engagement) to 33% (math achievement).[12] It is important to note that between one quarter and one third of the total variance in achievement lies between schools (and thus is amenable to school effects). Only between-school variance may be influenced by school climate. Reliabilities for each outcome follow the same pattern as intraclass correlations. The most reliable outcome is mathematics achievement (0.91); the least reliable is engagement (0.59). These results suggest that HLM models may be more successful in locating school effects on achievement than engagement.

Within-school HLM models. Table 4 displays separate within-school HLM models on all outcomes. The models estimate the effects of student gender, SES, minority status, and academic

background on achievement within each school. but are unconditional at the school level. As before, as outcomes are in a z-score metric, so within-school HLM effects (*beta coefficients*, or βs) are effect sizes. Two β parameters are estimated as random effects (i.e., allowed to vary across schools): (1) the school average for each outcome ($\beta 0j$); and (2) the gender gap in each outcome ($\beta 1j$). Other student demographic controls (SES, minority status, academic background) are treated as "fixed" covariates (i.e., they are constrained to vary only within schools). Thus, we do not model these variables' effects on the outcomes as functions of school climate.

Table 4

Within-School HLM Models for Academic Achievements and Engagement with Learning

	Dependent Variables				
Independent Variables	Engagement with Learning	Reading Achievement	Math Achievement	Science Achievement	Social Studies Achievement
Random Effects					
School Average	0.11***	- 0.06**	0.05*	0.15***	0.10***
Gender Gap	0.32***	0.17***	- 0.11***	- 0.18***	- 0.14***
Fixed Effects *					
Socioeconomic Status	0.04**	0.22***	0.19***	0.20***	0.20***
Minority Status	- 0.10**	- 0.31***	- 0.32***	- 0.38***	- 0.33***
Academic Background	0.28***	0.31***	0.33***	0.28***	0.30***
Between-School Variance of School Average	0.05***	0.07***	0.13***	0.11***	0.13***
Between-School Variance of Gender Gap	0.01***	0.02***	0.02***	0.03***	0.03***

*$P \leq .05$
** $P \leq .01$
*** $P \leq .001$
* Variables under the fixed effect category have been constrained from varying randomly between schools, so that their effects represent pooled within-school effects.

As suggested in Table 2, SES, minority status, and academic background are strongly associated with all outcomes ($p<.001$). Eighth graders from higher-SES families and with stronger academic backgrounds score higher on all achievement tests and are more engaged with learning. Compared

to whites, minority students score lower in achievement and are less engaged. Gender gaps in these outcomes are consistent with Table 1, even after controlling for SES, minority status, and academic background (all $p<.001$—top of Table 4). Girls are significantly more engaged in learning, (ES = .32 SD), score higher in reading (.17 SD), but the gender gap favors boys in mathematics (-.11 SD), science (-.19 SD), and social studies (-.14). Except for a moderate positive advantage for girls in engagement, other gender effects are small in magnitude (regardless of direction). Gender gaps in mathematics, science, and social studies achievement (all favoring boys) increase somewhat once demographic controls are taken into account.[13] All school means and gender gaps vary significantly between schools (lower panel of Table 4), indicating that they may be modeled as functions of school climate in subsequent HLM analyses.

HLM School-Level Models

Model structure. Final HLM models estimate the effects of school climate on ten school-level outcomes: adjusted school means for engagement and the four achievement scores and the within-school gender gaps in each outcome. Engagement and achievement means may be viewed as "effectiveness" parameters; high means on these parameters indicate schools with high levels of achievement and engagement (taking into account the SES, race/ethnicity, and academic background of students who attend the school). We interpret gender gaps in engagement and achievement as "equity" parameters; smaller differences between boys and girls on outcomes suggest equitable learning environments.

Desirable school climate effects (*gamma coefficients*, in HLM) should simultaneously show two relationships: (1) positive effects on school mean engagement and achievement, and (2) effects that decrease gender gaps in these outcomes. As gender gaps in engagement and reading achievement are positive (they favor girls), on these outcomes an "equitable" climate effect would be negative (the female advantage would be reduced). Gender gaps in math, science, and social studies favor boys (i.e., are negative), so positive climate effects here would demonstrate equity (the negative gap would diminish). Our definition of equity says that gender differences, whether initially favoring boys or girls, should diminish or disappear. In numerical terms, the total gender difference is indicated by summing climate effects on the gender gap with the gap itself, and then observing whether its absolute magnitude decreases.

We address the difficulty of strong correlations among school climate measures with a two-step HLM analysis: (1) We estimated the effects of school composition and structure climate on all outcomes, (2) then, we estimated the effect of each measure of teaching/learning climate and normative climate individually, with the full set of composition and structure measures included as controls. Separate tables for each outcome (tables 5-9) include results for the school mean (top panel) and the gender gap (lower panel). Although each analysis includes all within-school student

demographic controls, we have simplified the full-model HLM tables by omitting those effects. (The effects are very similar to those shown in Table 4.) A full set of effects are available from the authors.

Engagement. Table 5 displays school climate effects on academic engagement. The gender gap is positive (β = .33, p<.001); averaged across schools, eighth-grade girls are more engaged in learning than their male counterparts. If desirable climate characteristics are defined as those that promote both effectiveness and equity, one element of normative climate shows this pattern: academically oriented learning environment. Schools with such environments have more engaged students (.15, p<.001), and they have smaller gender gaps in engagement (-.09, p<.01). Although average engagement is also positively associated with an orderly and safe climate (.16, p<.001) and with flexible curriculum organization (.05, p<.05), these climate characteristics are unrelated to the gender gap. The only composition/structure effect on engagement is for Catholic schools, whose students are more engaged with learning (.15, p<.05).

Table 5

Full HLM School Climate Model: Engagement with Learning

Type of Effects	Gamma Coefficients *
I. Effects on Intercept	
Average Intercept	- 0.16***
A. Composition and Structure Climate	
Average School SES	0.04
High Minority Concentration	- 0.04
Eighth-Grade Enrollment	- 0.04
Catholic School	0.15*
Independent School	0.03
B. Teaching and Learning Climate	
Flexible Curriculum Organization *	0.05*
Authentic Instruction *	0.02
Positive Student and Teacher Relations *	0.11
C. Normative Climate	
Orderly and Safe Environment *	0.16***
Academic-Oriented Learning Environment *	0.15***
Parental Involvement in School *	0.02
II. Effects on Gender Gap	
Average Gender Gap	0.33***
A. Composition and Structure Climate	
Average School SES	0.02
High Minority Concentration	- 0.03
Eighth-Grade Enrollment	- 0.01
Catholic School	- 0.05
Independent School	- 0.14
B. Teaching and Learning Climate	
Flexible Curriculum Organization *	- 0.02
Authentic Instruction *	0.01
Positive Student and Teacher Relations *	- 0.01
C. Normative Climate	
Orderly and Safe Environment *	- 0.02
Academic-Oriented Learning Environment *	- 0.09**
Parental Involvement in School *	0.00

~$P \leq .10$
* $P \leq .05$
** $P \leq .01$
*** $P \leq .001$

* The within-school model was controlled for socioeconomic status, minority status, and academic background. The between-school model was adjusted by average school SES, minority concentration, school enrollment, and atttendance in Catholic and Independent schools.

BEST COPY AVAILABLE

Reading achievement. School climate effects on reading achievement are displayed in Table 6. As with engagement, eighth-grade girls score higher in reading achievement than counterpart boys (β = .21, p<.001). Reading achievement is higher in schools that are safe and orderly (.05, p<.05) and marginally higher in schools where authentic instruction is emphasized (.03, p<.10). No teaching/learning and normative climate measures are associated with the gender gap in reading. Although reading achievement is higher in schools with higher average SES (.08, p<.01), the gender gap favoring girls in reading is larger in higher-SES schools (.08, p<.001). Catholic schools show the desired pattern of effectiveness and equity in reading. In Catholic schools, students read better than their public-school counterparts (.17, p<.01), and the reading gender gap is smaller (-.17, p< .01) than in public schools. Curiously, the gender gap in reading is also reduced in larger schools (-.07, p<.05), but school size is unrelated to school average reading achievement. This contradicts findings by Lee and Smith (1995) that social stratification in achievement is increased in larger high schools.

Table 6

Full HLM School Climate Model: Eighth-Grade Reading Achievement

Type of Effects	Gamma Coefficients *
I. Effects on Intercept	
Average Intercept	- 0.05*
A. Composition and Structure Climate	
Average School SES	0.08**
High Minority Concentration	- 0.12*
Eighth-Grade Enrollment	0.03
Catholic School	0.17**
Independent School	0.33
B. Teaching and Learning Climate	
Flexible Curriculum Organization *	0.02
Authentic Instruction *	0.03~
Positive Student and Teacher Relations *	0.00
C. Normative Climate	
Orderly and Safe Environment *	0.05*
Academic-Oriented Learning Environment *	0.09***
Parental Involvement in School *	- 0.01
II. Effects on Gender Gap	
Average Gender Gap	0.21***
A. Composition and Structure Climate	
Average School SES	0.08**
High Minority Concentration	0.03
Eighth-Grade Enrollment	- 0.07**
Catholic School	- 0.17**
Independent School	- 0.28
B. Teaching and Learning Climate	
Flexible Curriculum Organization *	- 0.03
Authentic Instruction *	- 0.01
Positive Student and Teacher Relations *	0.02
C. Normative Climate	
Orderly and Safe Environment *	0.02
Academic-Oriented Learning Environment *	0.02
Parental Involvement in School *	- 0.04

~$P \leq .10$
* $P \leq .05$
** $P \leq .01$
*** $P \leq .001$

* The within-school model was controlled for socioeconomic status, minority status, and academic background. The between-school model was adjusted by average school SES, minority concentration, school enrollment, and attendance in Catholic and Independent schools.

BEST COPY AVAILABLE

Mathematics achievement. The effects of school climate on eighth graders' math achievement are shown in Table 7. The gender gap in math favors males (β = -.11, p<.001). As this gender gap is negative, we look for positive relationships of school climate measures with this gap to induce gender equity in schools. No single school climate measure satisfies both the effectiveness and equity criteria for mathematics achievement. Although schools that are safe and orderly, that emphasize academic learning, and that enroll higher-SES students have higher student achievement in mathematics, these climate measures have no effect on the gender gap in math. Interestingly, parental involvement is unrelated to a school's average math achievement but, it actually increases the gender gap. In schools where parents are more involved, boys have an even larger advantage over girls in mathematics achievement (-.09, p<.01), reflecting findings from Stevenson and Baker's (1987) study.

Table 7

Full HLM School Climate Model: Eighth-Grade Math Achievement

Type of Effects	Gamma Coefficients *
I. Effects on Intercept	
Average Intercept	0.17***
A. Composition and Structure Climate	
Average School SES	0.25***
High Minority Concentration	- 0.07
Eighth-Grade Enrollment	- 0.01
Catholic School	- 0.19**
Independent School	0.12
B. Teaching and Learning Climate	
Flexible Curriculum Organization *	0.03
Authentic Instruction *	0.02
Positive Student and Teacher Relations *	0.02
C. Normative Climate	
Orderly and Safe Environment *	0.06*
Academic-Oriented Learning Environment *	0.07*
Parental Involvement in School *	0.04
II. Effects on Gender Gap	
Average Gender Gap	- 0.11***
A. Composition and Structure Climate	
Average School SES	0.02
High Minority Concentration	0.06
Eighth-Grade Enrollment	- 0.01
Catholic School	- 0.02
Independent School	- 0.09
B. Teaching and Learning Climate	
Flexible Curriculum Organization *	0.00
Authentic Instruction *	- 0.02
Positive Student and Teacher Relations *	0.01
C. Normative Climate	
Orderly and Safe Environment *	0.02
Academic-Oriented Learning Environment *	0.01
Parental Involvement in School *	- 0.09**

~$P \leq .10$
* $P \leq .05$
** $P \leq .01$
*** $P \leq .001$

* The within-school model was controlled for socioeconomic status, minority status, and academic background. The between-school model was adjusted by average school SES, minority concentration, school enrollment, and attendance in Catholic and Independent schools.

BEST COPY AVAILABLE

Science achievement. School climate effects on eighth graders' science achievement are shown in Table 8. As with math, girls perform less well in science achievement than their male counterparts (β = -.20, p<.001). Few school climate factors influence the gender gap in science achievement, although the female disadvantage is marginally larger in schools with more positive student-teacher relations (-.04, p<.10), consistent with a trend suggested in our literature review. Some climate effects on school average science achievement are positive: Achievement is higher in schools with flexible curriculum organizations (.08, p<.01), in orderly and safe schools (.07, p<.05), and in schools with academically oriented learning environments (.06, p<.05). Demographic composition is especially strongly associated with achievement in science: Schools with more advantaged students show higher average achievement in science (an average school SES effect of .15, p<.001; a high-minority effect of -.20, p<.001) .

Table 8

Full HLM School Climate Model: Eighth-Grade Science Achievement

Type of Effects	Gamma Coefficients *
I. Effects on Intercept	
Average Intercept	0.24***
A. Composition and Structure Climate	
Average School SES	0.15***
High Minority Concentration	- 0.20***
Eighth-Grade Enrollment	0.00
Catholic School	- 0.09
Independent School	0.17
B. Teaching and Learning Climate	
Flexible Curriculum Organization *	0.08**
Authentic Instruction *	0.02
Positive Student and Teacher Relations *	0.02
C. Normative Climate	
Orderly and Safe Environment *	0.07*
Academic-Oriented Learning Environment *	0.06*
Parental Involvement in School *	0.01
II. Effects on Gender Gap	
Average Gender Gap	- 0.20***
A. Composition and Structure Climate	
Average School SES	- 0.03
High Minority Concentration	0.07
Eighth-Grade Enrollment	- 0.03
Catholic School	- 0.07
Independent School	- 0.08
B. Teaching and Learning Climate	
Flexible Curriculum Organization *	- 0.03
Authentic Instruction *	- 0.01
Positive Student and Teacher Relations *	- 0.04 ~
C. Normative Climate	
Orderly and Safe Environment *	- 0.05
Academic-Oriented Learning Environment *	- 0.04
Parental Involvement in School *	- 0.04

~$P \leq .10$
* $P \leq .05$
** $P \leq .01$
*** $P \leq .001$

* The within-school model was controlled for socioeconomic status, minority status, and academic background. The between-school model was adjusted by average school SES, minority concentration, school enrollment, and attendance in Catholic and Independent schools.

Social studies achievement. The effects of school climate on achievement in social studies are shown in Table 9. As with math and science, girls perform below boys in social studies (β = -.15, p<.001). Regarding the gender gap in social studies, a somewhat surprising picture emerges: Higher average social studies achievement occurs in schools that are Catholic, schools with positive student-teacher relations, and schools that have more academically oriented learning climates; however, these same school characteristics are associated with increased gender gaps favoring boys (i.e., schools with these climates are effective but not equitable on this outcome). A few climate factors are positively related to school mean social studies achievement (effectiveness) but not the gender gap (equity): order and safety (.11, p<.001), parent involvement (.06, p<.05), higher average SES (.18, p<.001), and a low proportion of minority students (-.11, p<0.01)

Table 9

Full HLM School Climate Model: Eighth-Grade Social Studies Achievement

Type of Effects	Gamma Coefficients *
I. Effects on Intercept	
Average Intercept	0.14***
A. Composition and Structure Climate	
Average School SES	0.18***
High Minority Concentration	- 0.11**
Eighth-Grade Enrollment	0.03
Catholic School	0.21**
Independent School	0.14
B. Teaching and Learning Climate	
Flexible Curriculum Organization *	0.03
Authentic Instruction *	0.03
Positive Student and Teacher Relations *	0.04*
C. Normative Climate	
Orderly and Safe Environment *	0.11**
Academic-Oriented Learning Environment *	0.14***
Parental Involvement in School *	0.06*
II. Effects on Gender Gap	
Average Gender Gap	- 0.15***
A. Composition and Structure Climate	
Average School SES	- 0.01
High Minority Concentration	0.03
Eighth-Grade Enrollment	- 0.04
Catholic School	- 0.15*
Independent School	- 0.04
B. Teaching and Learning Climate	
Flexible Curriculum Organization *	- 0.02
Authentic Instruction *	- 0.02
Positive Student and Teacher Relations *	- 0.04*
C. Normative Climate	
Orderly and Safe Environment *	- 0.03
Academic-Oriented Learning Environment *	- 0.08*
Parental Involvement in School *	- 0.02

~$P \leq .10$
* $P \leq .05$
** $P \leq .01$
*** $P \leq .001$

* The within-school model was controlled for socioeconomic status, minority status, and academic background. The between-school model was adjusted by average school SES, minority concentration, school enrollment, and atttendance in Catholic and Independent schools.

BEST COPY AVAILABLE

Summary

Our analyses show that elements of the climates of middle-grade schools are associated with school effectiveness (increasing levels of achievement and engagement) more frequently than with social equity (minimizing differences in outcomes between male and female eighth graders). Reasons for smaller effects of school climate on equity than effectiveness relate to both the substantive and statistical properties of the outcomes. When we consider outcome distributions among schools (as any study of school climate effects must do), mean differences in achievement and engagement are simply larger and more reliable than school-by-school differences in how boys and girls perform on these outcomes. Although systematic gender differences are statistically significant in analyses with large sample sizes and are certainly substantively meaningful, they are also small in absolute terms, inconsistent in direction, and only modest proportions of their variability is between schools. Some gender differences favor girls (engagement, reading) and some favor boys (math, science, social studies). One is of moderate size (engagement, β = .33 SD), but most are small (β's ranging from .11 to .21 SD).[14]

Discussion

The Effects of School Climate on Engagement, Achievement, and Gender Equity

Rather than viewing "school climate" as a singular feature of schools, we define it multidimensionally, considering the climate of teaching and learning, the elements of normative climate, and the climate defined by a school's structure and composition. Our analyses also take into account characteristics of students (besides gender) known to influence the outcomes we consider. Because of the methods we use, and the extensive statistical controls we include, we conclude that the climate effects we identify here are *real* and not artifacts of other unmeasured features of schools and students.

Teaching and learning climate. Three elements of teaching/learning climate were considered: flexible curriculum structure, the authenticity of instruction, and positive relations between teachers and students. Despite the importance of these characteristics of instruction, in an analysis that focuses on schools, these climate measures have very few effects—and those effects center on effectiveness rather than the equity parameters. For example, students in schools where the curriculum structure is more flexible are more engaged and score higher in science; social studies achievement is higher in schools where relations between students and teachers are more positive; students in schools with authentic instruction score marginally higher in reading comprehension. The few effects of this construct on equity are troubling: In schools with more positive teacher-student relations, the gender gap favoring males in science and social studies is even larger. Though

the direction of most findings is supportive of flexibility, authenticity, and positive social relations, our generally modest findings for this construct indicate that these elements of climate are more likely to typify *classrooms* than *schools*. Unfortunately, NELS was not designed to study the climate of classrooms.

Normative climate. Compared to teaching and learning climate, effects associated with schools' normative climates—order and safety, academic orientation, and parent involvement—are more prevalent, although also stronger for effectiveness than equity. Students in schools that have a more academic learning environment (in particular) and a safer and more orderly atmosphere are significantly more engaged and demonstrate significantly higher scores on achievement tests in all areas of the curriculum measured by NELS. Schools with more involved parents also have higher-scoring students in social studies. One normative element of climate, academic orientation, is associated with gender equity in several outcomes, although the effects are not always as we would like. In more academically oriented schools, boys and girls are equivalently engaged; however, in these same schools, the gender gap in social studies favoring males increases by almost half (from –.15 SD to –.23 SD). Also, schools with higher levels of parent involvement are even less favorable environments for girls' learning in math: Here, the usually small gender gap favoring boys is almost doubled (from -.11 SD to -.20 SD).

Thus, we conclude that elements of schools' normative climates, particularly those that focus on academic orientation, order, and discipline, are important for students' learning. However, such climate factors, while favorable overall, do not influence students' learning in an equitable manner. The "engagement gender gap" is diminished, but the gender gaps in math and social studies are magnified. It is very difficult to argue that school environments characterized by more academic orientation, order, discpline, and involved parents are not desirable; in fact, our results indicate rather strongly that these elements of climate do influence students' learning across the curriculum. But there seem to be some undersirable side effects of such climates for girls.

Composition and structure climate. Demographic features of schools do affect their climates, as we argued at the outset, particularly if they affect learning even after accounting for demographic characteristics of students. The way students are assigned to schools is a conscious feature of U.S. educational policy, with minority and economically disadvantaged students "packed" into certain neighborhoods and schools. Our results indicate that these compositional decisions affect eighth graders' learning (and thus, school effectiveness) across the curriculum.

Although eighth-grade size has few residual effects in our analyses, governance does. That is, students in Catholic (compared to public) middle-grade schools are favored in terms of engagement, reading comprehension, and social studies, but are disadvantaged in math achievement in conparision with their public school counterparts.[15] We were surprised that school climate defined by school composition and structure had effects on gender equity for only one outcome: reading

comprehension. The gender gap in reading favoring girls *increases* in high-SES schools (from .21 SD to .29 SD) but *decreases* in smaller schools (from .21 SD to .14 SD) and in Catholic schools (from .21 to .04 SD). The effects on equity of this type of climate, on this outcome, were the strongest in our study.

Implications for Policy

Some findings from this study have serious implications for educational policy and research. Our discussion focuses on two different dimensions of the research: (1) the study of gender differences, and (2) the study of school climate. Although our study attempts to interweave these topics, we tease out the implications separately. Neither policymakers nor researchers have typically seen these issues as intertwined.

Expanding the dimensions of studying gender differences. We suggest a more "equitable approach" to the study of educational equity. The public discourse around issues of gender in school needs some change. The usual approach to gender differences should be expanded. Not all academic outcomes favor boys, nor are all as large as some recent public discussions would imply. We would like to see the study of gender equity moved away from the political arena. Some recent "arena" discussions have been unpleasant public interchanges that benefit no one. Inequity can (and does) work in both directions. True equity in educational outcomes occurs when there are no gender (or race or class) differences in these outcomes, regardless of direction or magnitude.

We have tried to follow this rule here, by attaching equal importance to (a) identifying elements of school climate that raise boys' engagement with school or reading comprehension to the higher levels evidenced by girls in these outcomes, and (b) identifying school factors that raise girls' achievement in areas where boys seem to outperform them (mathematics, science, and social studies). Most gender-difference studies focus on the disadvantages of girls. To the extent that girls *actually* experience some explicit or implicit sexism in their education, this is appropriate. The lack of focus on potential disadvantages for boys, we argue, suggests that the usual approach to studying gender differences in educational outcomes may not be truly equitable. Part of the reason for an overemphasis on gender differences unfavorable to girls is the location of the studies in the domains of math and science. Our nation seems to attach more importance to these subjects because of their obvious human capital connection (i.e., higher marketplace value for people with these skills). We would argue that reading comprehension has equal "value."

The most important implication of the findings also concerns expanding a dimension of research in another direction: school reform. Moving schools to improve the overall academic performance and behaviors of students may actually increase stratification within schools between social groups (in this case, between girls and boys). The potential stratification that may result from reform is "overlooked" because most research and policy discussions about school reform do not

consider that reforms often *shown* to be "good" for students on average (in this case, increasing the academic orientation of schools, fostering positive interactions between teachers and students, and increasing parent involvement) may not benefit one social group to the same degree as another. In our opinion, any reform that increases social stratification of educational outcomes by race, class, or gender should be questioned, no matter how much it benefits the dominant group(s). We advocate a hard-line stance on this approach to school reform. Closing the gender gap means that we must raise the achievement of the lowest-ranked group, not reduce the achievement of the group on top. One obvious conclusion from our review of the literature on school climate is how seldom issues of gender are even considered.

Altering the study of school climate. Our choice of topic suggests the importance we attach to the study of school climate. The organization or climate of schools has profound effects on students. How researchers in a particular study approach the topic, conceptually and methodologically, has serious implications for research findings. Most studies we reviewed were flawed at the design and analysis levels. Climate studies are by nature hierarchical or multilevel, but most research has ignored this nesting and used inappropriate analysis techniques. "School climate" is not a singular concept, moreover. How climate is defined, how effects are conceptualized and measured, and how elements of school climate affect students vary, depending on the level of the school (elementary, middle, or secondary). In both senses of "level"—grade level and analysis level—multilevel studies are absent from this literature.

An important caveat to the study of educational climate is that *school climate* must be differentiated from *classroom climate*. The study of the climate of instruction needs to be focused on data collected in classrooms, and this type of climate could easily vary considerably within the same school. Our findings about the teaching and learning climate of schools were disappointing precisely for this reason (i.e., we did not have access to data collected systematically from a variety of students in particular classroooms, but rather were restricted to data from relatively small numbers of randomly selected students in large numbers of classrooms). In this regard, we are impressed by Barr and Dreeben's (1983) elegant research design in their study of reading instruction in first grade. Their design and findings emphasized the importance of distinguishing elements of climates according to the level where the major proportion of variation occurs. In their case, the important levels were districts, schools, classrooms, and instructional groups.

Implementing reforms that change the organization of schools. A final point concerns the difficulty of implementing the sorts of reforms suggested by our findings. Viewing school reform as interested outsiders, we recognize that changing a school's basic organization or climate is not simple. Rather, we need to move schools, one by one, in particular directions that are supported (we hope) by school members (administrators, teachers, parents, and students). Making schools more academically oriented, for example, involves much more than increasing academic offerings; raising

the number of course requirements for graduation; de-tracking; increasing teachers' emphasis on homework, tests, and projects; or increasing the length of the school day or year. Improving teacher-student relations cannot be done by decree from the top. Creating more orderly and safe school environments goes well beyond adding metal detectors, security guards, or even "conflict resolution" programs. We are talking about reforms that involve fundamental changes to schools.

In short, we conclude that changing school climate to increase both educational effectiveness and equity is a challenging proposition in terms of both research and implementation. Research that identifies the elements of school climate that might benefit students in these two ways needs to be altered. And implementing the reforms suggested by research is not a "tinkering at the edges" undertaking. However, we also point out that neither the gender differences detected in this study nor the climate effects on these "gaps" are large. Thus, many school reforms, defined in this paper in terms of changing the climates of schools, are (fortunately) gender neutral. We hope this study expands the needed dialogues to help those interested in such changes along the paths to these desirable goals.

Technical Notes

[1] The political debate about the magnitude and importance of the "gender gap" surrounds, at least in part, the American Association of University Women (AAUW's) activity in the last half decade to bring gender equity issues in K-12 education to the public's attention. In addition to supporting research and issuing a series of reports (e.g., AAUW Educational Foundation, 1992), AAUW has been active in efforts to introduce requirements for gender equity into federal legislation, as well as trying to influence state policies in regard to gender and education. AAUW's visible and active public stance has also engendered some harsh criticism. Although the AAUW Educational Foundation has supported the research described in this paper, the organization has not influenced the research design, analysis, findings, or conclusions. We take full responsibility for the study.

[2] Topics considered in research on school climate include such aspects of school culture as teacher commitment; peer norms; academic expectations and emphasis; consistency, clarity, and consensus of goals; and teachers' use of praise and rewards. Ecological aspects of schools (e.g., building size), descriptors of the milieu (e.g., the morale of teachers or students), and measures of the social system (e.g., administrative organization or ability grouping) are also typically considered (see Anderson, 1982; Lee et al., 1993; Pallas, 1988).

[3] Because the focus of the study is on the effects of school climate on gender differences within schools, single-sex schools were excluded from the analysis. We define single-sex schools as those that enroll less than 20% of either sex.

[4] Because the current version of the hierarchical linear modeling software installed on the University of Michigan's mainframe computer can handle only 377 schools for a multilevel analysis, we reduced the public school sample to accommodate this feature. We adjusted the design weights to reflect this sampling procedure (see footnote 6 for details).

[5] The resulting unweighted sample sizes for students and schools after each filter was applied were summarized as follows: (a) selecting students with full NELS data sources resulted in 22,237 students in 984 schools; (b) selecting non-single-sex public, Catholic, and independent schools with at least 10 NELS-sampled students in them resulted in 20,660 students in 876 schools; (c) randomly sampling down public schools resulted in 9,020 students in 377 schools.

[6] To compensate for sampling down public schools, we weighted up the public schools. Specifically, we adjusted the original NELS school and student design weights by multiplying them by the inverse of the probability of public schools and public school students being sampled. The student and school adjusted weights were then restandardized to have a mean of 1 for the samples we used. For the HLM analyses, only the adjusted school weights were used. Details about the computation of adjusted weights and about results of our tests of the appropriateness of these adjusted weights are available from the authors.

[7] Although it could be argued that measures of school composition and structure represent important school-level control variables in a multivariate, multilevel analytic model, we suggest that the composition and structure climate construct represents an important element of school climate. These contrasting views do not affect analytic models; rather they determine the importance placed on effects.

[8] We combined African Americans, Hispanics, and Native Americans into a single "minority status" group, and whites and Asian Americans into a comparison group for three reasons. First, minority status is not the focus of the study. Its major function in this study is to serve as a control variable for the analysis of gender differences. Second, previous studies suggest that while African Americans, Hispanics, and Native Americans have different schooling experiences and educational outcomes, these differences are relatively smaller compared to the differences between minorities and whites. Third, the small number of Native Americans and Asian Americans in the sample does not permit separate analysis of these subgroups. Most educational research finds Asian Americans' and whites' experiences to be quite similar.

[9] To interpret the magnitudes of effect sizes in substantitve terms, we follow the lead of Rosenthal & Rosnow (1984). Effect sizes of .5 SD or more are considered large; effect sizes .3-.5 SD are moderate; effects .1-.3 SD are small; and those less than .1 SD are trivial.

[10] However, this conclusion does not exclude the possibility that certain school characteristics may systematically enlarge or reduce the within-school gender gap.

[11] Multi-colinearity means that there is substantial correlation among variables. This problem produces unstable partial coefficients for the highly correlated variables and large standard errors for the coefficients, reducing the probability of rejecting the null hypothesis and enlarging confidence intervals. As shown in Table 2, many school climate measures are strongly interrelated. Each measures different aspects of schools and may have quite different effects on the outcomes. Thus, we decided to evaluate the effects of each measure of school climate in the teaching/learning and normative constructs separately, to avoid producing unstable results due to colinearity.

[12] The intraclass correlation is defined as the ratio of the variability in the outcome (called "tau" in HLM) between schools to the total variability (tau + "sigma-squared," or variability within schools pooled across schools). Each intraclass correlation in Table 3 is computed by adjusting the within-school variability (sigma-squared) by the reliability of the corresponding outcome, which is an estimate of the ratio of parameter variance (or true score) to the total variance (or the observed score—Bryk & Raudenbush, 1992). The intraclass correlation for mathematics achievement, for example, is computed as follows: .30/(0.30+[0.69*0.91]) = 32.60%.

[13] Recall that we used a self-report of students' grades between sixth and eighth grades to construct the measure of academic background (see Appendix A for full details). Grades are often found to favor girls. This is partly due to the fact that grades are not only a measure of student performance but also of student behaviors. Girls are known to exhibit more amenable behaviors in the school setting than boys. Thus, gender differences in mathematics, science, and social studies achievement *increase* after controlling for academic background—a suppression effect (see Cohen & Cohen, 1975, p. 86ff.).

[14] It may also be the case that factors inducing gender differences are more likely to be classroom-based rather than school-based. The structure of NELS data, with modest numbers of students randomly sampled in each school (but not in each classroom), does not allow us to examine this possibility.

[15] The Catholic school effect on the gender gap presents an interesting finding. For reading achievement, where girls are generally favored, the gap closes in Catholic schools. In science and

math, which favor boys, Catholic school attendance has no effect on the gender gap. In social studies, which also favors boys, the gender gap is increased for Catholic school students. Thus, when Catholic school attendance affects the gender gap in achievement, it would appear that the effect is not favorable to girls.

References

American Association of University Women (AAUW). (1993). *Hostile hallways: The AAUW survey on sexual harassment in America's schools*. Washington, DC: American Association of University Women Educational Foundation.

American Association of University Women (AAUW). (1992). *The AAUW report: How schools shortchange girls*. Washington, DC: American Association of University Women Educational Foundation.

American Association of University Women (AAUW). (1991). *Shortchanging girls, shortchanging America*. Washington, DC: American Association of University Women.

Anderson, C. S. (1982). The search for school climate: A review of the research. *Review of Educational Research, 52*(2), 368-420.

Astin, H. S. (1974). Sex differences in mathematical and science precocity. In J. C. Stanley, D. P. Keating, & L. H. Fox (Eds.), *Mathematical talent: Discovery, description and development*. Baltimore: Johns Hopkins University Press.

Barr, R. & Dreeben, R. (1983). *How schools work*. Chicago: University of Chicago Press.

Bidwell, C. E. (1965). The school as a formal organization. In J. G. March (Ed.), *Handbook of organizations*. Chicago: Rand McNally.

Brunkhorst, B. J. (1992). A study of student outcomes and teacher characteristics in exemplary middle and junior high science programs. *Journal of Research in Science Teaching, 29*(6), 571-583.

Bryk, A. S. & Driscoll, M. E. (1988). *The high school as community: Contextual influence and consequences for students and teachers*. Madison, WI: National Center on Effective Secondary Schools, University of Wisconsin-Madison.

Bryk, A. S. & Raudenbush, S. W. (1992). *Hierarchical linear models: Application and data analysis methods*. Newbury Park, CA: Sage.

Cannon, R. K. & Simpson, R. D. (1985). Relationships among attitude, motivation, and achievement of ability grouped, seventh-grade, life science students. *Science Education, 69*(2), 121-138.

Carnegie Council on Adolescent Development. (1989). *Turning points: Preparing American youth for the 21st century*. New York: Carnegie Corporation.

Cohen, E. G. & Lotan, R. A. (1995). Producing equal-status interaction in the heterogeneous classroom. *American Educational Research Journal, 32*(1), 99-120.

Cohen, J. & Cohen, P. (1975). *Applied multiple regress/correlation analysis for the behavioral sciences* (1st ed.). Hillsdale, NJ: Erlbaum.

Comer, J. P. (1988). Educating poor minority children. *Scientific American*, 259, 42-48.

Comer, J. P. (1985). Demand for excellence and the need for equity: The dynamics of collaboration. In M. Fantini & R. Sinclair (Eds.), *Education in school and non-school settings (84th yearbook of the National Society for the Study of Education)*. Chicago: University of Chicago Press.

Crossman, M. (1987). Teachers' interactions with girls and boys in science lessons. In A. Kelly (Ed.), *Science for girls*. Philadelphia: Open University.

Eccles, J. S. (1989). Bringing young women to math and science. In M. Crawford & M. Gentry (Eds.), *Gender and thought: Psychological perspectives*. New York: Springer-Verlag.

Entwisle, D. R., Alexander, K. L., & Olson, L. S. (1994). The gender gap in math: Its possible origins in neighborhood effects. *American Sociological Review*, 58, 822-838.

Epstein, J. L. (1991). Effects of student achievement of teachers' practices of parent involvement. In S. B. Silvern & B. A. Hutson (Eds.), *Advances in reading/language research, Vol. 5: Literacy through family, community, and school interaction*, (pp. 261-275). Greenwich, CT: JAI Press.

Fiqueira-McDonough, J. (1986). School context, gender, and delinquency. *Journal of Youth and Adolescence*, *15*(1), 79-98.

Friedkin, N . E. & Neocochea, J. (1988). School system size and performance: A contingency perspective. *Educational Evaluation and Policy Analysis*, *10*(3), 237-249.

Gaddy, G. (1988). High school order and academic achievement. *American Journal of Education, 97*, 496-518.

Garbarino, J. (1980). Some thoughts on school size and its effects on adolescent development. *Journal of Youth and Adolescence*, 9, 19-31.

Ginsburg, G. S. & Bronstein, P. (1993). Family factors related to children's intrinsic/extrinsic motivational orientation and academic performance. *Child Development*, 64, 1461-1474.

Good, T. L., Sikes J. N., & Brophy, J. E. (1973). Effects of teacher sex and student sex on classroom interaction. *Journal of Educational Psychology*, 63, 617-624.

Grolnick, W. S. & Slowiaczek, M. L. (1994). Parent's involvement in children's schooling: A multidimensional conceptualization and motivation model. *Child Development*, *65*(1), 237-252.

Hallinan, M. & Smith, S. S. (1989). Classroom characteristics and student friendship cliques. *Social Forces*, *67*(4), 898-919.

Hallinan, M. T. & Sorensen. A. B. (1987). Ability grouping and sex differences in mathematics achievement. *Sociology of Education*, 60, 63-72.

Hallinan, M. T. (1994). School differences in tracking effects on achievement. *Social Forces*, *72*(3), 799-821.

Ingels, S. J., Abraham, S. Y., Rasinski K., Karr R., Spencer B. D., & Frankel, M. R. (1989). *National educational longitudinal study of 1988. Base year: Student component data file user's manual*. Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement, NCES 90-464.

Jones, A. T. & Kirk, C. M. (1990). Gender differences in students' interests in applications of school physics. *Physics Education*, 25, 308-313.

Jones, L. R., Mullis, I. V. S., Raizen, S. A., Weiss, I. R., & Weston, E. A. (1992). *The 1990 science report card*. Princeton, NJ: Educational Testing Service.

Jones, M. G. & Wheatley, J. (1990). Gender differences in teacher-student interactions in science classrooms. *Journal of Research in Science Teaching*. 27(9), 861-874.

Kahle, J. B., Matyas, M. L., & Cho, H. (1985). An assessment of the impact of science experiences on the career choices of male and female biology students. *Journal of Research in Science Teaching*, 22(5), 385-394.

BEST COPY AVAILABLE

Lee, V. E. & Bryk, A. S. (1989). A multilevel model of the social distribution of high school achievement. *Sociology of Education*, *64*(3), 78-94.

Lee, V. E., Bryk, A. S., & Smith, J. B. (1993). The organization of effective high schools. In L. Darling-Hammond (Ed.), *Review of Research in Education*, 20 (pp. 172-267). Washington, DC: American Educational Research Association.

Lee, V. E. & Burkam, D. T. (1996). Gender differences in middle-grade science achievement: Subject domain, ability level, and course emphasis. *Science Edition*, February 1996.

Lee, V. E., Croninger, R. G., Linn, E., & Chen, X. (in press). The culture of sexual harassment in secondary schools. *American Educational Research Journal*.

Lee, V. E. & Smith, J. B. (1993). Effects of school restructuring on the achievement and engagement of middle-grade students. *Sociology of Education*, 66, 164-187.

Lee, V. E. & Smith, J. B. (1995). Effects of high school restructuring and size on gains in achievement and engagement for early secondary school students. *Sociology of Education*, *68*(4), 241-270.

Linn, M. C. & Hyde, J. S. (1989). Gender, mathematics, and science. *Educational Researcher*, *18*(8), 17-27.

Moos, R. H. & Moos, B. S. (1978). Classroom social climate and student absences and grades. *Journal of Educational Psychology*, *70*(2), 263-269.

Morse, L. W. & Handley, H. M. (1985). Listening to adolescents: Gender differences in science classroom interaction. In L. C. Wilkinson and C. B. Marrett (Eds.), *Gender influences in classroom interactions*. New York: Academic Press.

National Center for Education Statistics (1991). *Trends in academic progress: Achievement of American students in science 1970-90, mathematics 1973-90, reading 1979-90, and writing 1984-90*. Washington, DC: Author.

Newmann, F. M. (1981). Reducing student alienation in high schools: Implications of a theory. *Harvard Educational Review*, 51, 546-564.

Oakes, J. (1990). Opportunities, achievement, and choice: Women and minority students in science and mathematics. In C. B. Casden (Ed.), *Review of Research in Education*, 16, (pp. 153-222). Washington, DC: American Educational Research Association.

Orenstein, P. [in association with the American Association of University Women] (1994). *SchoolGirls: Young women, self-esteem, and the confidence gap*. New York: Doubleday.

Orland, M. E. (1990). Demographics of disadvantage: Intensity of childhood poverty and its relationship to educational achievement. In J. I. Goodlad & P. Keating (Eds.), *Access to knowledge: An agenda for our nation's schools*, (pp. 43-58). New York: College Entrance Examination Board.

Pallas, A. M. (1988). School climate in American high schools. *Teacher's College Record*, *89*(4), 541-554.

Parsons, J. E., Kaczala C. M., & Meece, J. L. (1982). Socialization of achievement attitudes and beliefs: Classroom influences. *Child Development*, 53, 322-339.

Peterson, P. & Fennema, E. (1985). Effective teaching, student engagement in classroom activities, and sex-related differences in learning mathematics. *American Educational Research Journal*, 22(3), 309-335.

Petersen, R. P., Johnson, D. W., & Johnson, R. T. (1991). Effects of cooperative learning on perceived status of male and female pupils. *The Journal of Social Psychology*, 131, 717-735.

Pittman, R. B. (1991). Social factors, enrollment in vocational/technical courses, and high school dropout rates. *Journal of Educational Research*, *84*(5), 288-295.

Rosenthal, R. & Rosnow, R.L. (1984). *Essentials of behavioral research: Methods and data analysis*. New York: McGraw Hill.

Sadker, M. & Sadker, D. (1994). *Failing at fairness*. New York: Charles Scribner and Sons.

Schmidt, P. (1994). Idea of "gender gap" in schools under attack. *Education Week*, *14*(4), September 28, 1994, pp. 1, 16.

Simpson, A. W. & Erickson, M. T. (1983). Teachers' verbal and nonverbal communication patterns as a function of teacher race, student gender, and student race. *American Educational Research Journal*, *20*(2), 183-198.

Simpson, R. D. & Oliver, J. S. (1985). Attitude toward science achievement motivation profiles of male and female students in grades 6 through 10. *Science Education*, *69*(4), 511-526.

Simpson, R. D. & Oliver, J. S. (1990). A summary of major influences on attitude toward and achievement in science among adolescent students. *Science Education*, *74*(1), 1-18.

Spear, M. G. (1987). Teachers' views about the importance of science to boys and girls. In A. Kelly (Ed.), *Science for girls*. Philadelphia: Open University.

Steinberg, L., Lamborn, S. D., Dornbusch, S. M., & Darling, N. (1992). Impact of parenting practices on adolescent achievement: Authorative parenting, school involvement, and encouragement to succeed. *Child Development*, *63*, 1266-1281.

Stevenson, D. L. & Baker, D. P. (1987). The family-school relation and the child's school performance. *Child Development*, *58*, 1348-1357.

Waller, W. (1932). *The sociology of teaching*. New York: Russell & Russell.

Whitney, I. & Smith, P. K. (1993). A survey of the nature and extent of bullying in junior/middle and secondary schools. *Educational Research*, *35*(1), 3-25.

Wigfield, A., Eccles J. S., Mac Iver, D., Reuman, D. A., & Midgley, C. (1991). Transitions during early adolescence: Changes in children's domain-specific self-perceptions and general self-esteem across transition to junior high school. *Developmental Psychology*, *27*(4), 552-565.

Wilson, J. W. (1987). *The truly disadvantaged: The inner city underclass and public policy*. Chicago: The University of Chicago Press.

Appendix A

Description of Variables Used in the Gender and Middle-School Climate Study

Outcome Measures

Reading Achievement. IRT-adjusted formula score on a test of reading comprehension (BYTXRIRS). The measure was standardized, ranging from –1.93 to 1.61 with a mean of 0 and standard deviation (SD) of 1.

Math Achievement. IRT-adjusted formula score on a test of mathematics (BYTXMIRS). The measure was standardized, ranging from –1.29 to 1.94 with a mean of 0 and SD of 1.

Science Achievement. IRT-adjusted formula score on a test of science (BYTXSIRS). The measure was standardized, ranging from –1.93 to 2.51 with a mean of 0 and SD of 1.

Social Studies Achievement. IRT-adjusted formula score on a test of social studies (BYTXHIRS). The measure was standardized, ranging from –2.35 to 1.83 with a mean of 0 and SD of 1.

Engagement With Learning. We took a mean of three subfactors and then standardized it. The three subfactors are (1) positive learning behavior factor, (2) ready for class factor, and (3) school attendance factor. Factor eigenvalue = 1.80. Percent of variance explained by the factor = 59.9%. Cronbach's alpha = 0.66. The measure ranges from –1.89 to 3.75, with a mean of 0 and SD of 1.

The three subfactors are constructed as follows:

1. **Positive Learning Behavior Factor**: Standardized factor score using principal components factor analysis. Factor includes students' reports of frequency with which they were sent to the office for misbehaving (BYS55A, coding reversed), they were sent to the office with school work problems (BYS55B, coding reversed), their parents received a warning about grades (BYS55D, coding reversed), their parents received a warning about behavior (BYS55E, coding reversed), they got into a fight with another student (BYS55F, coding reversed), and their classmates see them as troublemakers (BYS56E, coding reversed). Factor eigenvalue = 2.92. Percentage of variance explained by the factor = 48.6% Cronbach's alpha = 0.78.

2. **Ready for Classroom Instruction Factor**: Standardized factor score using principal components factor analysis. Factor includes students' reports of how often they come to class without pencil/paper (BYS78A, coding reversed), how often they come to class without books (BYS78B, coding reversed), and how often they come to class without homework done (BYS78C, coding reversed). Factor eigenvalue = 1.90. Percentage of variance explained by the factor = 63.3%. Cronbach's alpha = 0.71.

3. **School Attendance Factor**: Standardized factor score using principal components factor analysis. Factor includes students' reports of days they missed from school in the past 4 weeks (BYS75, coding reversed), how often they cut or skipped classes (BYS76, coding reversed), the number of times they were late for school in the past 4 weeks (BYS77, coding reversed), and how often their parents received a warning about attendance (BYS55C, coding reversed). Factor eigenvalue = 1.73. Percentage of variance explained by the factor = 43.3%. Cronbach's alpha = 0.49.

Student-Level Control Measures

Gender. We recoded the NELS variable SEX so that 0 = Male and 1 = Female. Fifty percent (49.7%) of the students are female.

Minority status. We recoded the NELS variable RACE so that 0 = White or Asian and 1 = Black, Hispanic, or American Indian. Twenty-four percent (23.5%) of the students are minorities.

Socioeconomic status. We standardized the NELS variable BYSES on this sample. Thus, this measure has a mean of 0 and SD of 1, ranging from –3.60 to 2.45.

Academic background. A composite of three variables: (1) self-reported grades in science, math, English, and social studies for grades 6-8 (BYGRADS); (2) parents' reports of whether a student ever repeated a grade (BYP44, coding reversed); and (3) parents' reports of whether a student ever skipped a grade (BYP41). Students' reports of whether they ever repeated a grade (BYS74, coding reversed) was used in cases of missing parental reports. As the resulting measure was skewed, we took a natural logarithm transformation (which made it normally distributed) and then standardized it. The measure has a mean of 0 and SD of 1, with a range of –3.69 to 6.15.

School Climate Measures

1. Composite and Structure Climate

Average socioeconomic status. This measure was created by aggregating students' SES composite (BYSES) to the school level and then standardizing it. Thus, the measure has a mean of 0 and SD of 1, ranging from –2.07 to 2.47.

Minority concentration. This measure was created by (a) summing percentages of African American (BYSC13AP), Hispanic (BYSC13CP), and American Indian (BYSC13DP) eighth-grade students enrolled at each school, and (b) recoding the sum to a dichotomous variable with 0 = less than 40% minority students at school and 1 = 40% or more minority students at school. Eighteen percentage of the schools have a high minority concentration.

Eighth-grade enrollment. This measure was taken from the principal's report of eighth-grade school enrollment (BYSC3P). Since the distribution of the measure is skewed, we transformed the variable with a natural logarithm transformation (which made it normally distributed) and then

BEST COPY AVAILABLE

standardized it. Thus, this measure has a mean of 0 and standard deviation of 1, ranging from –2.06 to 2.59.

School sector. Two dummy coded variables were created from the principal's report of school type (G8CTRLP): (a) 1 = Catholic schools and 0 = public or independent schools; (b) 1 = Independent schools and 0 = public or Catholic schools. Twenty percent of schools are Catholic schools and one percentage are independent schools.

II. Teaching and Learning Climate

Flexible curriculum organization. A standardized factor composite was created from three subfactors using principal components factor analysis: (a) reduced departmentalization factor; (b) team teaching factor; (c) heterogeneous grouping factor. Factor eigenvalue = 1.44. Percent of variance explained by the factor = 48.2 percent. Cronbach's alpha = 0.44. The measure ranges from –1.56 to 2.12, with a mean of 0 and SD of 1.

The three subfactors were constructed as follows:

1. Reduced departmentalization: This measure was a dummy coded variable created from principals' reports of whether or not the eighth grade is predominantly departmentalized, self-contained, or semi-departmentalized (HES4); whether or not the school has formal departments with their own chairs (HES23F2); and the number of teachers the average student has (eliminating schools that have team teaching) (HES5C). The measure takes 1 as the code of reduced departmentalization if the school is predominantly self-contained or semi-departmentalized on the first measure, the school has no formal department chairs on the second measure, and the average student has three or fewer teachers on the third measure.

2. Team teaching factor: Standardized factor scores using principal components factor analysis. Factor includes principals' reports of whether or not school uses departmental team teaching (HES27C), uses interdisciplinary team teaching (HES28C), has flexible team scheduling (HES23H2), and interdisciplinary teachers share the same students (HES23G2). Factor eigenvalue = 1.60. Percent of variance explained by the factor = 53.4%. Cronbach's alpha = 0.56. The factor ranges from –1.14 to 1.85, with a mean of 0 and SD of 1.

3. Heterogeneous grouping factor: Standardized factor scores using principal components factor analysis. Factor includes principals' reports of whether the eighth graders keep the same classmates for all classes (HES6C); whether the school has non-grouped academic classes (HES7C2, HES7C3, HES7C4, HES7C5, HES7C6, and HES7C7); and whether the school has greater than 40% students in non-grouped academic classes (aggregated from students reports of whether they were in non-grouped English, math, science, and social studies classes). Factor eigenvalue = 1.77. Percent of variance explained by the factor = 58.9%. Cronbach's alpha = 0.64. The factor ranges from – 0.60 to 2.76, with a mean of 0 and SD of 1.

Authentic Instruction Factor. A standardized factor composite was created from four sub-factors using principal components factor analysis: (a) authentic instruction in English class factor; (b) authentic instruction in math class factor; (c) authentic instruction in science class factor; and (d) authentic instruction in social studies factor. Factor eigenvalue = 2.18. Percent of variance explained by the factor = 54.4%. Cronbach's alpha = 0.72. The measure ranges from –3.97 to 2.60, with a mean of 0 and SD of 1.

The four subfactors were constructed as follows:

1. *Authentic instruction in English class:* Standardized factor scores using principal components factor analysis. Factor includes principals' reports of how frequently the typical English class requires students to write at least one-page reports (HES19AA), teaches content and ideas in works of literature (HES19AC), requires students to rewrite and resubmit compositions after peer or teacher review (HES19AD), and has students make oral presentation (HES19AE). Factor eigenvalue = 1.94. Percent of variance explained by the factor = 48.5%. Cronbach's alpha = 0.63. Factor ranges from –2.48 to 2.72, with a mean of 0 and SD of 1.

2. *Authentic instruction in math class:* Standardized factor scores using principal components factor analysis. Factor includes principals' reports of how frequently the typical math class emphasizes creative problem-solving instruction (HES19BC), and emphasizes real-world math applications (HES19BD). Factor eigenvalue = 1.54. Percent of variance explained by the factor = 76.8%. Cronbach's alpha = 0.70. The factor ranges from –3.46 to 1.40, with a mean of 0 and SD of 1.

3. *Authentic instruction in science class:* Standardized factor scores using principal components factor analysis. Factor includes principals' reports of how frequently the typical science class requires students to conduct hands-on lab research (HES19CA) and emphasizes scientific methods of discovery (HES19CC). Factor eigenvalue = 1.36. Percent of variance explained by the factor = 68.1%. Cronbach's alpha = 0.53. The factor ranges from –3.16 to 1.77, with a mean of 0 and SD of 1.

4. *Authentic instruction in social studies class:* Standardized factor scores using principal components factor analysis. Factor includes principals' reports of how frequently the typical social studies class requires students to write at least one page of ideas (HES19DA), has students work on a group or joint project (HES19DB), discusses historical and current events issues (HES19DD), and has students be historians (HES19DE). Factor eigenvalue = 1.98. Percent of variance explained by the factor = 49.5%. Cronbach's alpha = 0.66. The factor ranges from –2.22 to 2.85, with a mean of 0 and SD of 1.

Positive Student and Teacher Relations. A standardized factor composite was first created by principal component factor analysis. Factor includes students' reports of the degree to which they get along well with teachers (BYS59A), the teaching is good (BYS59F), teachers are interested in

them (BYS59G), teachers praise their work (BYS59H), teachers do not put them down (BYS59I), and teachers listen to what they say (BYS59J). Factor eigenvalue = 2.93; Percent of variance explained by the factor = 48.8%. At the student level, Cronbach's alpha = 0.79. The factor was then aggregated to the school level and restandardized to the school sample. Thus, this measure ranges from –3.77 to 3.08, with a mean of 0 and SD of 1.

III. Normative Climate

Orderly and Safe Environment. A standardized factor composite was created from seven school-level subfactors using principal components factor analysis: (a) school problems perceived by students; (b) school problems perceived by teachers; (c) safe school environment perceived by students; (d) safe school environment perceived by parents; (e) orderly school environment perceived by students; (f) orderly school environment perceived by teachers; (g) orderly classroom perceived by students. Factor eigenvalue = 4.30. Percent of variance explained by the factor = 61.4%. Cronbach's alpha = 0.85. The measure ranges from –2.96 to 2.38, with a mean of 0 and SD of 1.

The seven subfactors were constructed as follows:

1. *School Problems Perceived by Students:* Standardized factor scores using principal components factor analysis. Factor includes students who disagree that physical conflict among students is a problem at school (BYS58D), robbery or theft is a problem at school (BYS58E), vandalism of school property is a problem at school (BYS58F), student use of alcohol is a problem at school(BYS58G), student use of illegal weapons is a problem at school (BYS58H), student possession of weapons is a problem at school (BYS58I), and physical abuse of teachers is a problem at school (BYS58J). Factor eigenvalue = 4.65. Percent of variance explained by the factor = 66.4%. At the student level, Cronbach's alpha = 0.92. The factor was then aggregated to the school level.

2. *School Problems Perceived by Teachers:* Standardized factor scores using principal components factor analysis. Factor includes teachers who disagree that physical conflict among students is a problem at school (BYT3_26D), robbery or theft is a problem at school (BYT3_26E), vandalism of school property is a problem at school (BYT3_26F), student use of alcohol is a problem at school (BYT3_26G), student use of illegal weapons is a problem at school (BYT3_26H), student possession of weapons is a problem at school (BYT3_26I), and physical abuse of teachers is a problem at school (BYT3_26J). Factor eigenvalue = 4.40. Percent of variance explained by the factor = 62.8%. At the teacher level, Cronbach's alpha = .90. The factor was then aggregated to the school level.

3. *Safe Environment Perceived by Students:* We aggregated the variable of students' reports that they feel safe at school (BYS59K, 1 = strongly disagree to 4 = strongly agree) to the school level.

4. *Safe Environment Perceived by Parents:* We aggregated the variable of parents' reports that the school is a safe place (BYP74I, recoded so that 1 = strongly disagree to 4 = strongly agree) to the school level.

5. *Orderly Environment Perceived by Students:* Standardized factor scores using principal components factor analysis. Factor includes students who disagree that student tardiness is a problem at school (BYS58A), student absenteeism is a problem at school (BYS58B), students cutting class is a problem at school (BYS58C), and verbal abuse of teachers is a problem (BYS58K). Factor eigenvalue = 2.39. Percent of variance explained by the factor = 59.9%. At the student level, Cronbach's alpha = 0.77. The factor was then aggregated to the school level.

6. *Orderly Environment Perceived by Teachers:* Standardized factor scores using principal components factor analysis. Factor includes reverse-coded versions of teachers who agree that student tardiness is a problem at school (BYT3_26A), student absenteeism is a problem at school (BYT3_26B), students cutting class is a problem at school (BYT3_26C), and verbal abuse of teachers is a problem (BYT3_26K). Factor eigenvalue = 2.88. Percent of variance explained by the factor = 71.9%. At the student level, Cronbach's alpha = 0.87. The factor was then aggregated to the school level.

7. *Orderly Classroom Perceived by Students:* Standardized factor scores using principal components factor analysis. Factor includes reverse-coded versions of students who disagree that other students often disrupt classroom (BYS59E), student disruptions inhibit learning (BYS59L), and misbehaving students often get away with it (BYS59M). Factor eigenvalue = 1.59. Percent of variance explained by the factor = 53.0%. At the student level, Cronbach's alpha = 0.56. The factor was then aggregated to the school level.

Academic-Oriented Learning Environment. A standardized factor composite was first created by principal component factor analysis. Factor includes parents' reports of the degree to which the school places a high priority on learning (BYP74A), homework assigned is worthwhile (BYP74B), their child is challenged at school (BYP74C), their child works hard at school (BYP74D), standards set by the school are realistic (BYP74F), the school prepares students well for high school (BYP74D), the school prepares students well for college (BYP74F), and students' reports of number of hours they spent on doing homework per week (BYHOMEWK). Factor eigenvalue = 3.95. Percent of variance explained by the factor = 49.4%. At the student level, Cronbach's alpha = 0.75. The factor was then aggregated to the school level and restandardized to the school sample. Thus, this measure ranges from –2.38 to 3.02, with a mean of 0 and SD of 1.

Parental Involvement in School. A standardized factor composite was first created by principal component factor analysis. Factor includes parents' reports of whether they belong to the parent-teacher organization (BYP59A), whether they attend parent-teacher organization meetings (BYP59B), whether they take part in parent-teacher organization activities (BYP59C), and whether they act as volunteers at the school (BYS59D). Factor eigenvalue = 2.21. Percent of variance explained by the factor –55.2%. At the parent level, Cronbach's alpha = 0.73. The factor was then aggregated to the school level and restandardized to the school sample. Thus, this measure ranges from –1.90 to 2.40, with a mean of 0 and SD of 1.

BEST COPY AVAILABLE

Appendix B

Brief Description of a Typical Hierarchical Linear Model Used in the Gender and Middle-School Climate Study

Within-School Models

A simple form of Hierarchical Linear Models (HLM) used here consists of two equations, a within- and a between-school model. Some of the parameters estimated in the within-school model become outcomes to be explained in between-school equations. One within-school model investigates the science achievement of student i in school j, Y_{ij}, as a function of student background characteristics, X_{ij}'s (the X-variables considered here are gender, SES, minority status, and academic background), and random error, R_{ij}:

$$Y_{ij} = \beta_{j0} + \beta_{j1}X_{ij1} + \beta_{j2}X_{ij2} + \ldots + \beta_{jk}X_{ijk} + R_{ij}$$

The β_{jk} regression coefficients are structural relations occurring within school j that indicate how achievement in each school is distributed across the measured student characteristics. In the HLM models investigated here, we are particularly interested in two β parameters:

β_{0j} = the average science achievement for students in school j; and

β_{1j} = the relationship between gender and science achievement in school j. We refer to this as the gender gap in science achievement.

While the other β parameters (i.e., distributional effects) were also estimated in our HLM analyses, we were not interested in modeling these parameters as functions of structural parameters. As such, the other within-school controls (SES, minority status, and academic background) are fixed in our HLM models. This means that we have "fixed" the between-school variability in these other β parameters to 0 (i.e., they do not vary randomly between schools).

Between-School Models

In the second set of equations, we model the random-effect β parameters, adjusted for student characteristics, as functions of school-level characteristics (W variables). We estimate a single

between-school model for each outcome, estimating separately the effects of each of the three school climate constructs on the outcomes (β_0 and β_1 for each outcome). For each model, we also adjust for the potentially confounding effects of school structure and composition. A typical between-school model is as follows:

$$\beta_{jk} = \gamma_{0k} + \gamma_{1k}W_{1j} + \gamma_{2k}W_{2j} + \ldots + \gamma_{pk}W_{pj} + U_{jk}$$

The parameters of interest here are the effects associated with the school climate variables, W_{1j}—the γ_{pk} coefficients. Since the error terms in this equation are complex, conventional linear model techniques may not be used. However, recent developments in statistical theory and computation, available through the HLM software, make this estimation possible. Briefly, the total variance in each outcome is partitioned into two components: parameter and error variance. Only effects on the parameter variance are estimated in HLM. This is an important development, since only variability in the structural parameters, $\text{Var}(\beta_{jk})$, can be explained by school factors. In general, previous efforts to estimate school effects with ordinary least squares regression have systematically underestimated school effects for this reason.

Resources: The AAUW Equity Library

Groundbreaking Works on Gender Bias in Education

Growing Smart: What's Working for Girls in School Executive Summary and Action Guide
Illustrated and highly readable summary of academic report described below. Includes detailed summary of full data report; action strategies for schools, families, and community leaders; resource list of programs nationwide with photos and firsthand accounts of some program participants; methodology; and selected bibliography. 60 pages/1995.
$10.95 AAUW members/$12.95 nonmembers.

Growing Smart: What's Working for Girls in School
Comprehensive academic review of more than 500 studies and reports identifies themes and approaches that promote girls' achievement and healthy development. Culturally conscious report urges experimentation with single-sex programs, cooperative learning groups, and other nontraditional approaches. 97-page white paper plus index/1995. Also includes copy of *Executive Summary and Action Guide*.
$32.95 AAUW members/$35.95 nonmembers.

SchoolGirls: Young Women, Self-Esteem, and the Confidence Gap
Doubleday, 1994. Riveting book by journalist Peggy Orenstein in association with AAUW shows how girls in two racially and economically diverse California communities suffer the painful plunge in self-esteem documented in *Shortchanging Girls, Shortchanging America*. 384 pages.
$18.95 AAUW members/$21.95 nonmembers.

Hostile Hallways: The AAUW Survey on Sexual Harassment in America's Schools
The first national study of sexual harassment in school, based on the experiences of 1,632 students in grades 8 through 11. Gender and ethnic/racial (African American, Hispanic, and white) data breakdowns included. Commissioned by the AAUW Educational Foundation and conducted by Louis Harris and Associates. 28 pages/1993.
$8.95 AAUW members/$11.95 nonmembers.

AAUW Issue Briefs
This set of five briefs explores gender equity issues including treatment of students, educator training, the curriculum, college admissions testing, and education and training. 1990-1995.
$7.95 AAUW members/$9.95 nonmembers.

How Schools Shortchange Girls: The AAUW Report
Marlowe paperback edition, 1995. A startling examination of how girls are disadvantaged in America's schools, grades K-12. With new foreword by Alice Ann Leidel. Includes recommendations for educators and policymakers as well as concrete strategies for change. 240 pages.
$11.95 AAUW members/$12.95 nonmembers.

The AAUW Report Executive Summary
Overview of *How Schools Shortchange Girls* research, with recommendations for educators and policymakers. 8 pages/1992.
$6.95 AAUW members/$8.95 nonmembers.

The AAUW Report Action Guide
Strategies for combating gender bias in school, based on *How Schools Shortchange Girls* recommendations. 8 pages/1992.
$6.95 AAUW members/$8.95 nonmembers.

Shortchanging Girls, Shortchanging America Executive Summary
Highly readable executive summary of the 1991 poll that awakened the nation to the problem of gender bias in America's schools. Poll shows graphically how classroom gender bias hurts girls' self-esteem, school achievement, and career aspirations. Revised edition, with updated account of poll's impact and review of school, community, and government action strategies, highlights survey results with charts and graphs. 20 pages/1994.
$8.95 AAUW members/$11.95 nonmembers.

Shortchanging Girls, Shortchanging America Video
A dramatic look at the inequities girls face in school. Features education experts and public policy leaders, AAUW poll results, and the compelling voices and faces of American girls. VHS format/15 minutes/1991.
$19.95 AAUW members/$24.95 nonmembers.

Girls Can! Video
Complement to *Shortchanging Girls, Shortchanging America*. An inspirational look at programs around the country that are making a difference in fighting gender bias in schools. VHS format/16 minutes/1995.
$19.95 AAUW members/$24.95 nonmembers.

Action Alert
AAUW's monthly newsletter monitoring congressional action on educational equity as well as reproductive choice, sexual harassment, and other vital issues. One-year subscription:
$20 AAUW members/$25 nonmembers.

Help Make a Difference for Today's Girls...and Tomorrow's Leaders

Become part of the American Association of University Women, representing 150,000 college graduates, and help promote education and equity for women and girls. You can add your voice as a member-at-large or work on critical issues in one of AAUW's more than 1,600 local branches. For further membership information, write: AAUW Membership, Dept. G, 1111 Sixteenth St. N.W., Washington, DC 20036-4873.

The AAUW Educational Foundation, a not-for-profit 501(c)(3) organization, provides funds to advance education, research, and self-development for women, and to foster equity and positive societal change. Your dollars support research, community action projects, and fellowships for women scholars and teachers. Send contributions to: AAUW Educational Foundation, Dept. 365, 1111 Sixteenth St. N.W., Washington, DC 20036-4873.

AAUW Resources Order Form

Name _____

Address _____

City/State/Zip _____

Daytime phone (_____) _____

AAUW membership # (if applicable) _____

Item	Circle Price Member/Nonmember	Quantity	Total
Growing Smart Executive Summary and Action Guide	**$10.95/$12.95**	_____	_____
Growing Smart: What's Working for Girls in School	**$32.95/$35.95**	_____	_____
SchoolGirls	**$18.95/$21.95**	_____	_____
Hostile Hallways	**$8.95/$11.95**	_____	_____
AAUW Issue Briefs 5-Pack	**$7.95/$9.95**	_____	_____
How Schools Shortchange Girls	**$11.95/$12.95**	_____	_____
How Schools Shortchange Girls Executive Summary	**$6.95/$8.95**	_____	_____
How Schools Shortchange Girls Action Guide	**$6.95/$8.95**	_____	_____
Shortchanging Girls Executive Summary	**$8.95/$11.95**	_____	_____
Shortchanging Girls Video	**$19.95/$24.95**	_____	_____
Girls Can! Video	**$19.95/$24.95**	_____	_____
Action Alert	**$20/$25 per year**	_____	_____
		Subtotal:	_____
		Tax *(DC, MD residents only)*:	_____
		International Order Surcharge *(25% of subtotal above)*:	_____
		Shipping/Handling:	$4.00
AAUW Membership-at-Large	**$35**	_____	_____
		TOTAL ORDER:	_____

For bulk pricing on orders of 10 or more, call 800/225-9998 ext. 365.
Please make check or money order payable in U.S. currency to AAUW. Do not send cash.
Credit cards are accepted for orders of $10 or more.

☐ MasterCard ☐ Visa Card #_ _ _ _ - _ _ _ _ - _ _ _ _ - _ _ _ _ Expiration _____

Name on card _____

Cardholder signature _____

SATISFACTION GUARANTEED: If you are not completely satisfied with your purchase, please return it within 90 days for exchange, credit, or refund. Videos are returnable only if defective, and for replacement only.

☐ Please send me information on joining an AAUW branch in my area (dues vary by branch).
☐ I'd like to join as a member-at-large. Enclosed is $35. (Fill in education information below.)

College/University _____ State/Campus _____ Year/Degree _____

FOR MAIL ORDERS, SEND THIS FORM TO:
AAUW Sales Office
Dept. 365
P.O. Box 251
Annapolis Junction, MD 20701-0251

FOR TELEPHONE ORDERS, CALL:
800/225-9998 ext. 365

CODE: D97NEL